Second Edition.

SAFETY PAMPHLET No. 12.

Safety Precautions
FOR
Transmission Machinery in Factories.

PART II.—BELT MOUNTING.

ISSUED BY THE HOME OFFICE.

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CONTENTS.

Safety Precautions for Transmission Machinery.

PART II.—BELT MOUNTING.

INTRODUCTION.

This pamphlet deals with the precautions to be taken in connection with the mounting of belts on driving pulleys. Fencing and other safety precautions for transmission machinery have already been dealt with in Safety Pamphlet No. 1.

The heavy toll of accidents due to transmission machinery is largely produced by the common practice of mounting belts at ordinary speed by direct handling at the driving pulley. It is, therefore, important that safe methods of mounting belts should be adopted. Such accidents will be eliminated only by avoiding approach to the shaft while it is in motion, and the object of this pamphlet is to set out, for the guidance of employers and others concerned, information collected both in this country and abroad as to the methods which have been adopted to overcome the danger. It is not claimed that these devices have all stood the test of long practical experience, but it is hoped that the ideas thus put forward may result in a fuller study by skilled engineers of a problem which has received too little attention in this country, and may assist to stimulate invention and the production of belt mounting appliances of possibly greater utility than those introduced hitherto.

Some of the devices illustrated in this pamphlet can be seen in actual operation at the Home Office Industrial Museum, Horseferry Road, London, S.W.1.

Although it is recognised that no single safeguard has been found to deal with every case, yet a large proportion of the accidents which occur would be prevented by the adoption of such safeguards as are available.

Careful examination of the problem shows that safety may be secured in a variety of ways, e.g. :—

(1) Stopping the machinery, or running it dead slow under suitable conditions.

(2) Sectionalising the machinery.

(3) Mounting, at ordinary speed, by means of a belt pole, or where this is impracticable, by a mechanical or other special type of belt mounter.

(4) Maintaining belts in satisfactory working order by efficient and systematic attention and inspection, and installing suitable driving arrangements.

(5) Enforcing safe practices on the part of the workers.

I.—STOPPING OR SLOWING-DOWN OF MACHINERY.

It is already the practice in many works for the shafting to be stopped whenever a belt has to be mounted during working hours. This course is always to be recommended where practicable, but it has to be recognised that mounting is more easily achieved with the shafting in motion, and where complete stoppage is not practicable the shafting should always be run dead slow—say at about six revolutions a minute.

In the case of large steam-driven installations the barring engine can be used for the purpose. Similarly, in the case of electrically-driven plant, safety is afforded by installing controllers fitted with arrangements for " inching " the shafting—such as are exhibited in the Home Office Industrial Museum—the controllers being operated by push-button units suitably distributed. The ordinary motor starter is not designed for " inching," though sometimes used to attain this end, the motor being slowly started, and stopped again after a short interval, by moving the starting arm to the first stud and back again. This is bad practice and for various reasons not to be recommended.

But even where the shafting is run dead slow it is desirable that :—

(*a*) only experienced and skilled workers should approach the machinery, and

(*b*) suitable clothing should be worn, e.g., a tightly-buttoned, single-piece overall, free from loose ends, and

(*c*) means should be at hand to secure prompt stoppage of the machinery should occasion so require.

II.—SECTIONALISING OF MACHINERY.

Where it is impracticable or inconvenient to stop or slow-down the whole of the plant, the difficulty may largely be got over by sectionalising the plant and thus limiting the stoppage to the particular section concerned. If it is not possible to increase the number of motors, such sectionalising can be achieved by the provision of friction clutches on the various shafting lines, or even by a more extended use of fast and loose pulleys.

The use of clutches in this way is being largely extended in industry, not only for this reason but because of the great economy secured by their use in the running of works machinery. Sections so controlled may be shut down when not required, as for instance where a night shift is worked in one or two departments only. Wear and tear are reduced, trouble with loose pulleys is avoided, and urgent repairs to machinery can be undertaken under safe conditions in working hours.

Modern designs of friction clutches are illustrated in Figures 1 to 6. In factories the clutches usually take the form of shaft couplings (Figures 1 to 3) but clutch-driven pulleys are also largely used (Figures 4 and 5). The clutch shown in section (Figure 6) drives a pulley (not shown) keyed to the extended boss. Clutch operating gear is shown in Figures 1, 2 and 4.

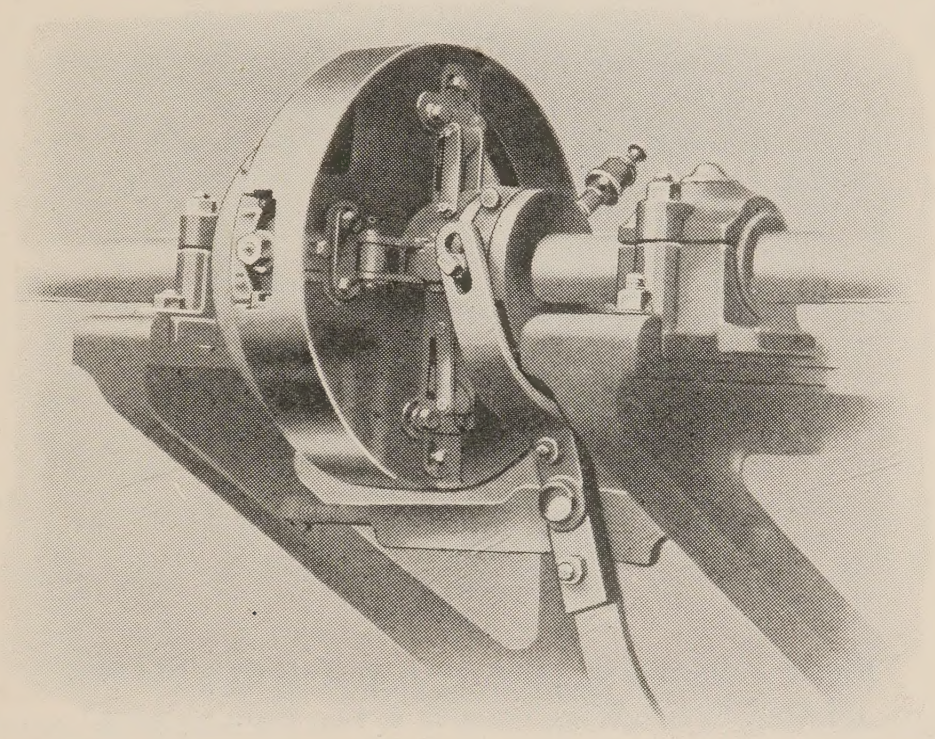


FIG. 1.—RIM FRICTION CLUTCH.
(Messrs. Crofts (Engineers), Ltd., Bradford.)

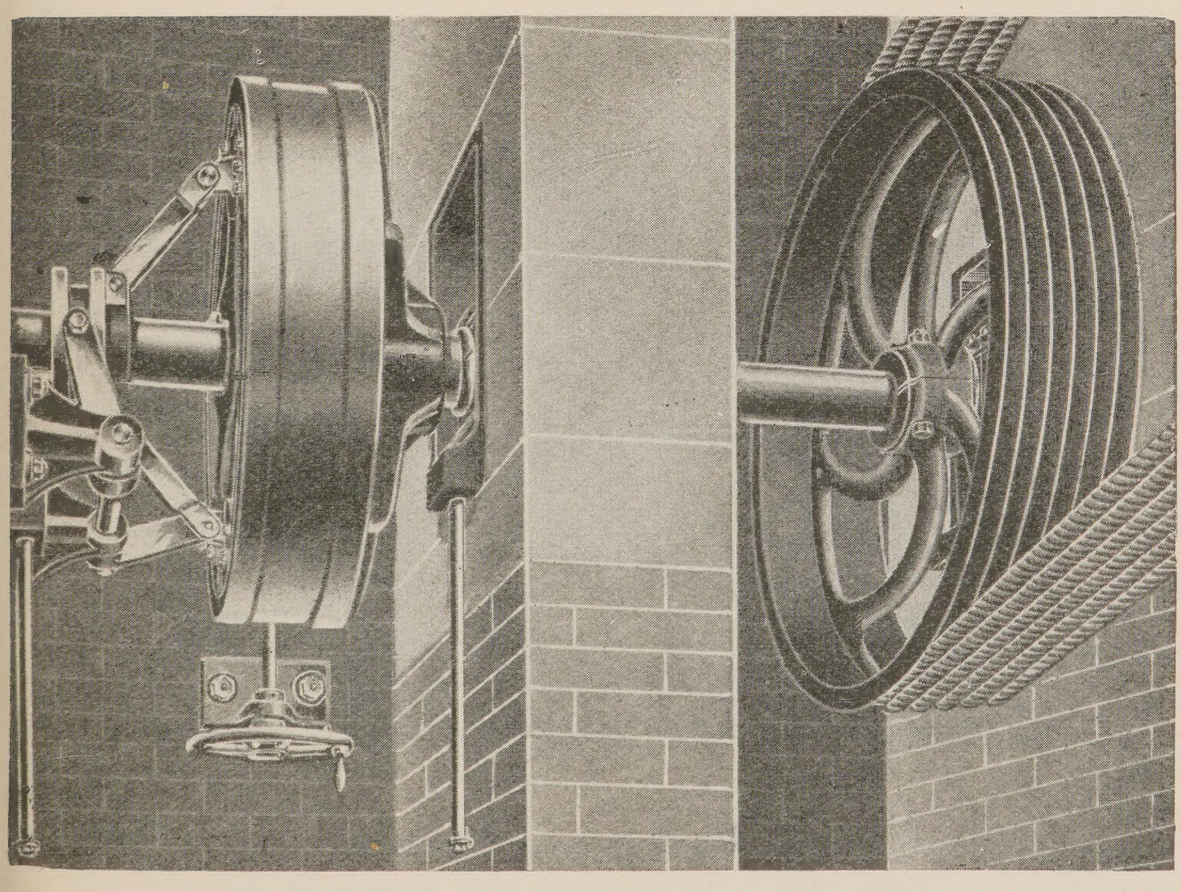


FIG. 2.—"HEYWOOD AND BRIDGE" FRICTION CLUTCH.
(Messrs. David Bridge & Co., Ltd., Castleton, Rochdale.)

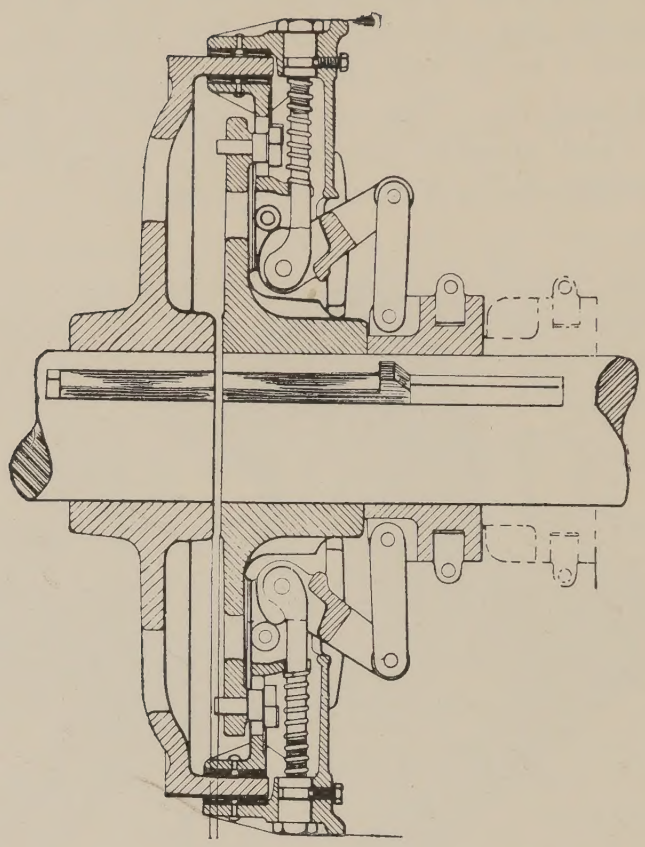


Fig. 3.—Sectional View of Rim Friction Clutch.
(Messrs. Frank Wigglesworth & Co., Ltd., Shipley.)

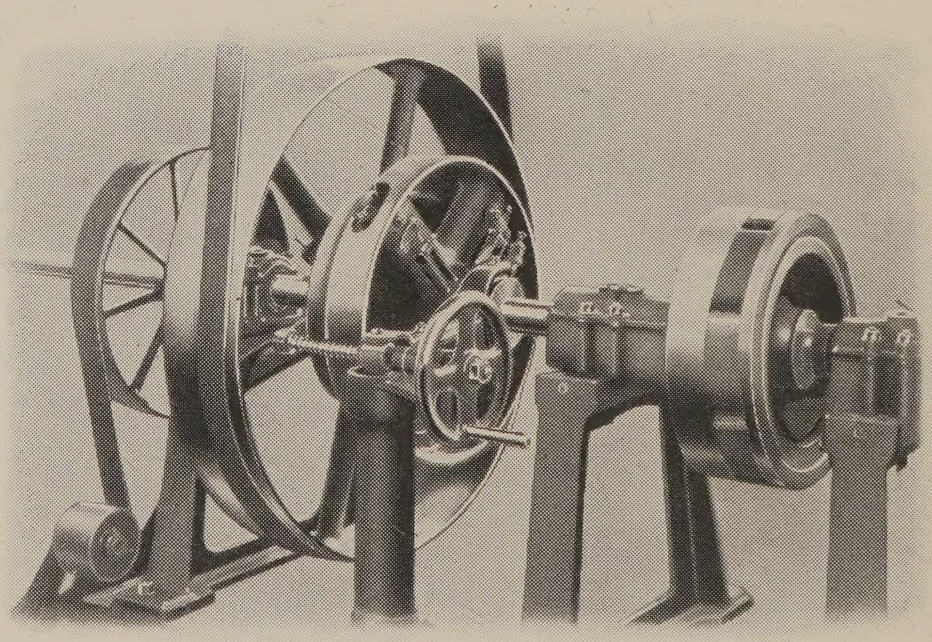


Fig. 4.—Friction Clutch Pulley.
(Messrs. Crofts (Engineers), Ltd., Bradford.)

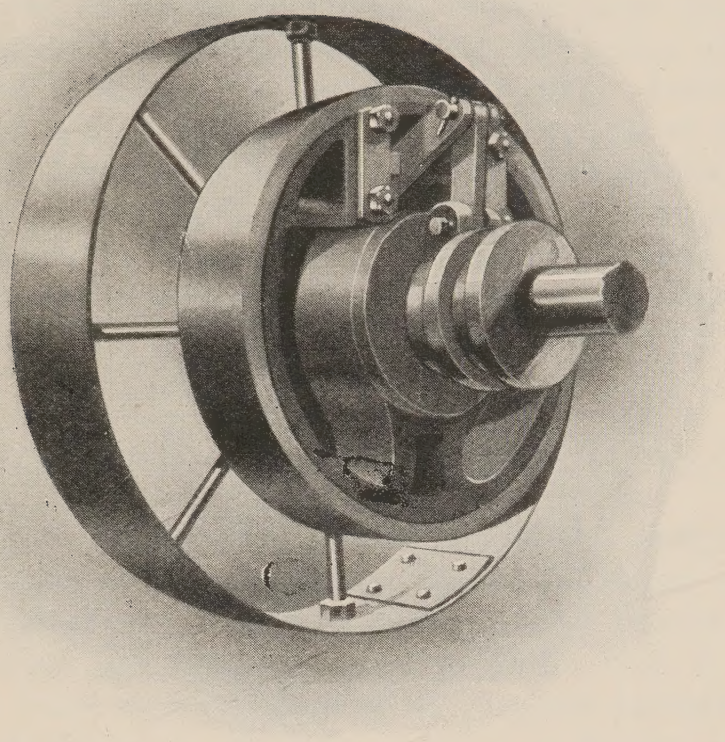


FIG. 5.—FRICTION CLUTCH PULLEY.
(Messrs. Archibald Edmeston & Sons, Ltd., Patricroft, Manchester.)

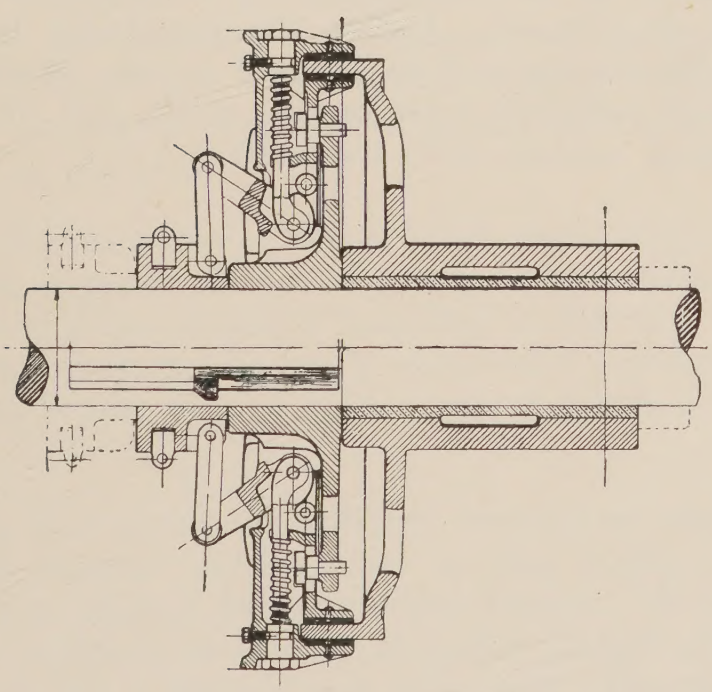


FIG. 6.—SECTIONAL VIEW OF CLUTCH FOR PULLEY (pulley not shown).
(Messrs. Frank Wigglesworth & Co., Ltd., Shipley.)

The choice of a clutch for a particular transmission duty demands expert advice. As the normal power transmission may be much less than the duty occasionally required, e.g., when starting up on load, the most severe conditions likely to be met with must be carefully estimated and a clutch with the necessary reserve of power selected. The clutch must be capable of being engaged or disengaged in any position, either when at rest or in motion, of gradually and smoothly starting the given load from rest to full speed, and of driving without slipping. When slipping occurs great heat may be generated and the risk of causing a fire must not be overlooked. Necessary adjustments of the clutch should be made only by skilled workers.

III.—BELT MOUNTING AT ORDINARY SPEED.

Belt Perches.—When a belt is dismounted, during work, from the driving pulley, it should not be allowed to ride freely upon the shaft, but should be supported by a suitably designed belt hanger or perch. A belt riding or hanging upon the revolving shaft is a serious potential danger, as it may unexpectedly seize upon the shaft and so cause an accident through a worker being caught by the belt and drawn up to the shaft. Accidents resulting in material damage as well as personal injury have also been caused by such belts having become entangled with the machinery.

The belt is sometimes tied in a knot (Fig. 7) and remains suspended upon the shaft, or, it may be tied to a fixture overhead, clear of the shaft. These methods are not satisfactory, as, if the belt is required to be remounted during working hours, it must first be untied or released. Unless the machinery is stopped or run dead slow the worker will be exposed to risk, in the first case, if the belt should suddenly seize on the shaft, and, in the second case, of accidental contact with the shaft.

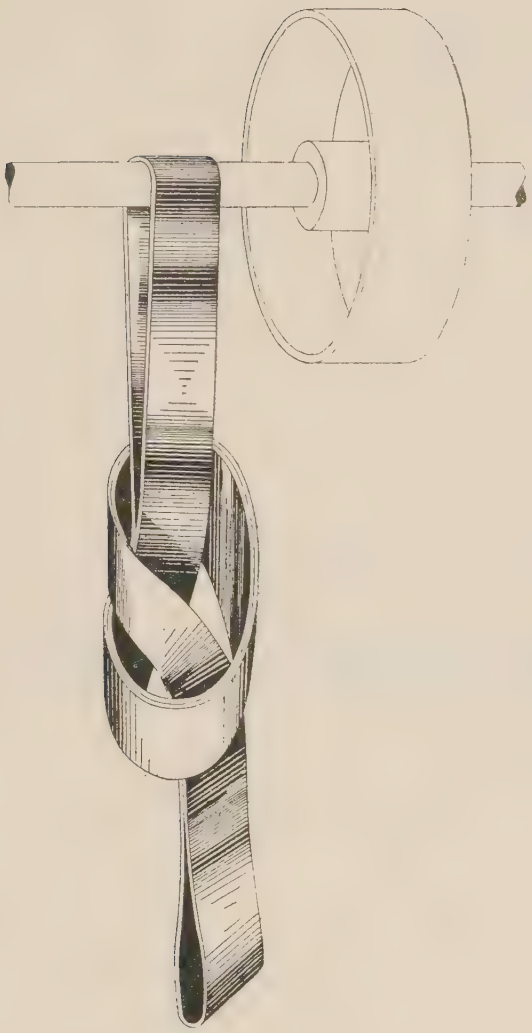


FIG. 7.—KNOTTED BELT RIDING ON SHAFT.
(*Not* good practice—see page 8.)

The risks associated with dismounted belts can only be effectively met by the provision of efficient belt hangers or perches. These appliances are not only of great value as safeguards for this purpose, but in many cases afford much assistance to a worker when replacing the belt.

A belt perch is an essential detail of all mechanical belt mounters. Special types of perch have been devised for certain drives which are so effective when correctly installed in relation to the driving pulley that the belt can be easily mounted by means of a pole or stick. These types, termed belt mounter perches, are described at p. 30.

The simple belt perch for ordinary vertical or inclined drives is a fixed belt support placed close to the pulley, securely and rigidly bolted to ceiling, beam or other fixture. It takes the form either of (i) a sleeve or trough of metal placed round the shaft (Figure 8), or (ii) a strong iron belt hook (Figure 9), the type usually adopted. It affords the advantage that, when suitably constructed and fitted, the belt is kept clear of the pulley arms.

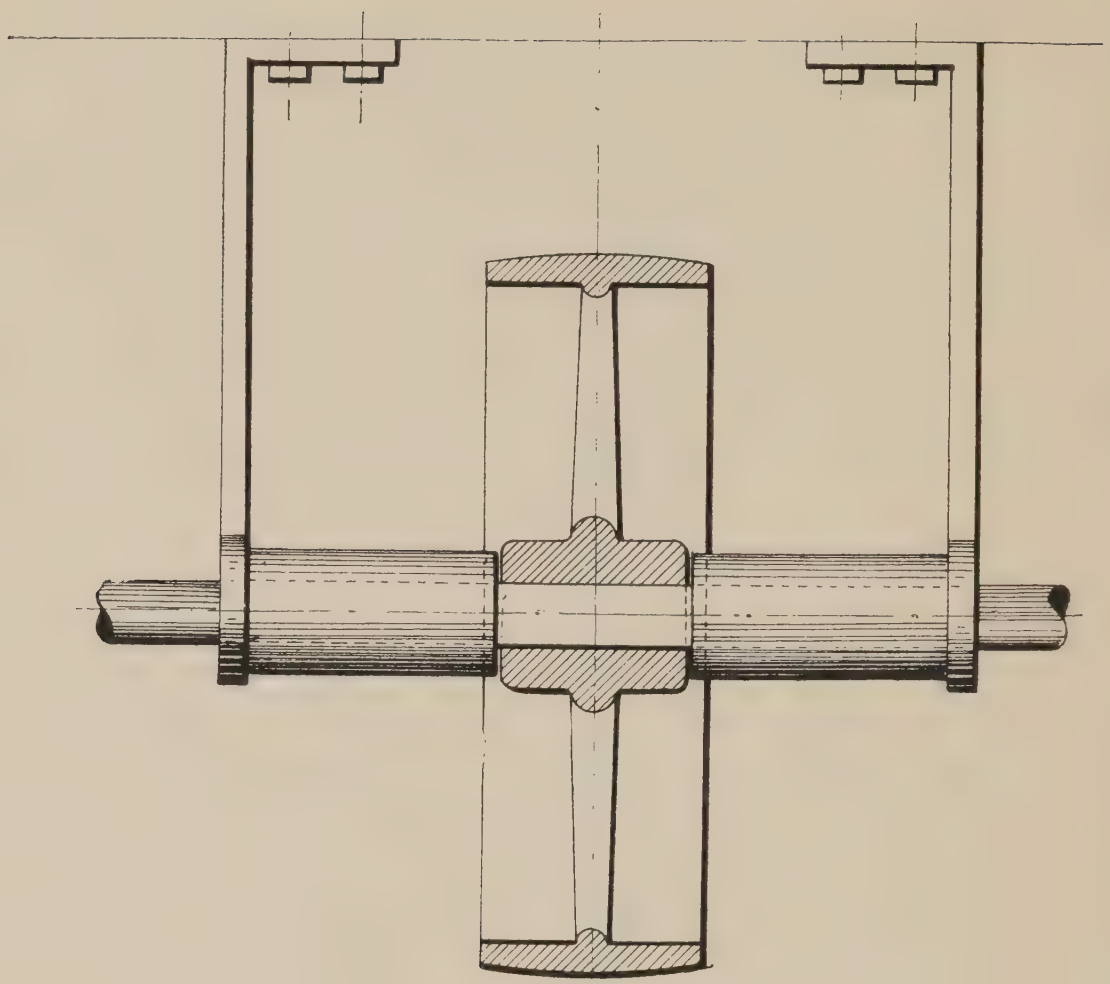


FIG. 8.—SLEEVE BELT PERCHES.

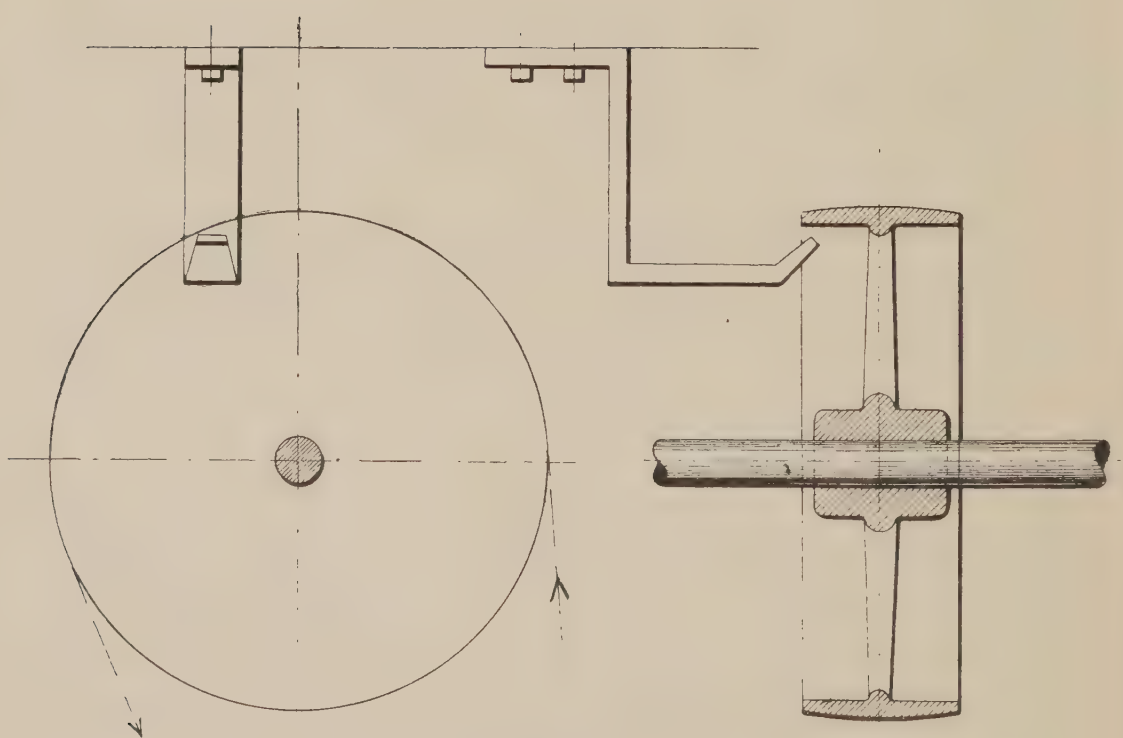


FIG. 9.—HOOK BELT PERCH.

The perch should be made either of round bar or flat bar with rounded edges, to avoid damaging the belt. It must have adequate strength and stiffness having regard to the conditions of transmission. Flat bar, $1\frac{1}{2}$ inches wide and $\frac{3}{8}$ inch deep, would be suitable in ordinary cases for belts up to 5 inches in width, if the suspended arm of the perch is not more than 18 inches long. The horizontal support should be at least half an inch longer than the width of the belt. The end of the hook should be inclined towards the pulley rim at about 45 degrees, and project under it about $\frac{5}{8}$ inch, the point being close up to the inside of the rim and about $1\frac{1}{4}$ inches, measured radially, beyond the belt support.

Where an ordinary belt pole is used for replacing the belt, the position of the hook in relation to the arc of contact of the belt must be carefully chosen. As the mounting pin of the pole may have to be passed over rather more than half this arc, the hook should be fixed a little beyond the midpoint of the arc, measured from the point of intake of the belt. For a vertical drive, the hook is placed a little beyond the vertical diameter of the pulley. Figure 9 shows the correct position for a slightly inclined drive. The displacement beyond the midpoint of the arc of contact is, in ordinary cases, about 2 inches.

If the belt is required to be dismounted on either side of the pulley, two perches must be provided (Figure 10). If, on the

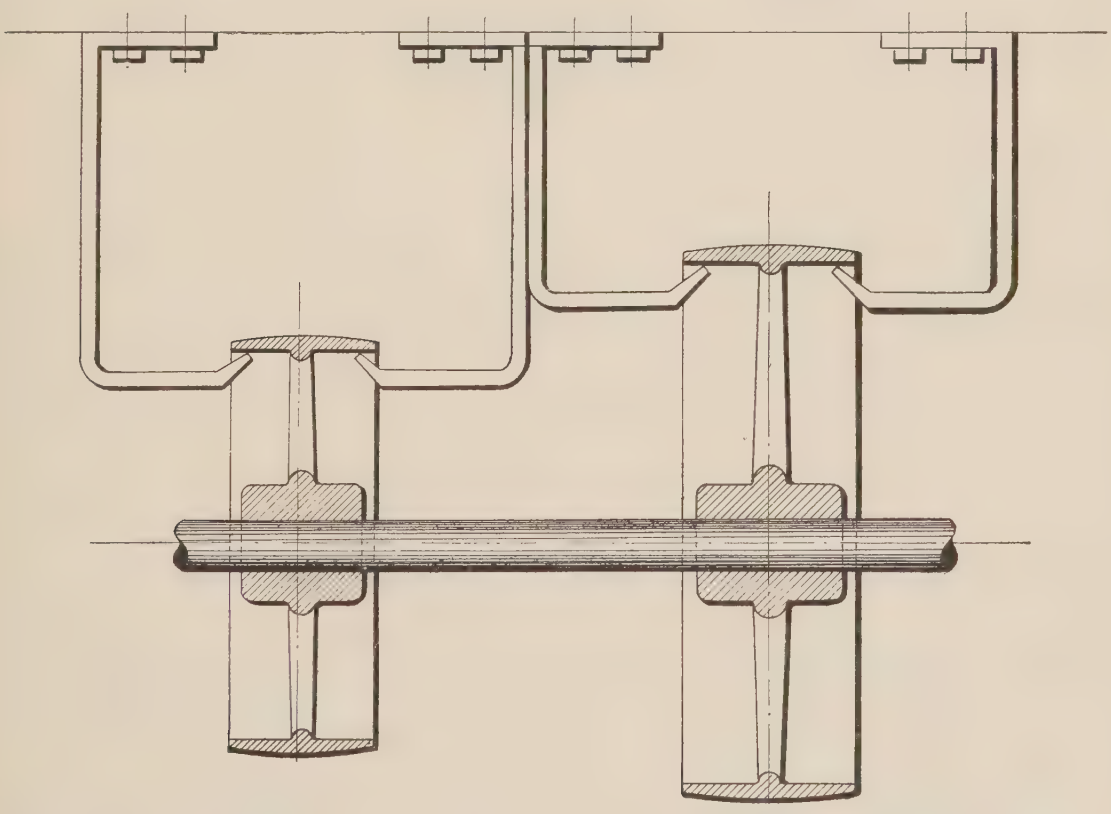


Fig. 10.—Hook Belt Perches on Both Sides of Pulley.

other hand, safety requires that the belt be dismounted on one side only, e.g., if the pulley is situated close to a bearing, or where two pulleys are close together, the stop shown in Figure 11 should be fitted.

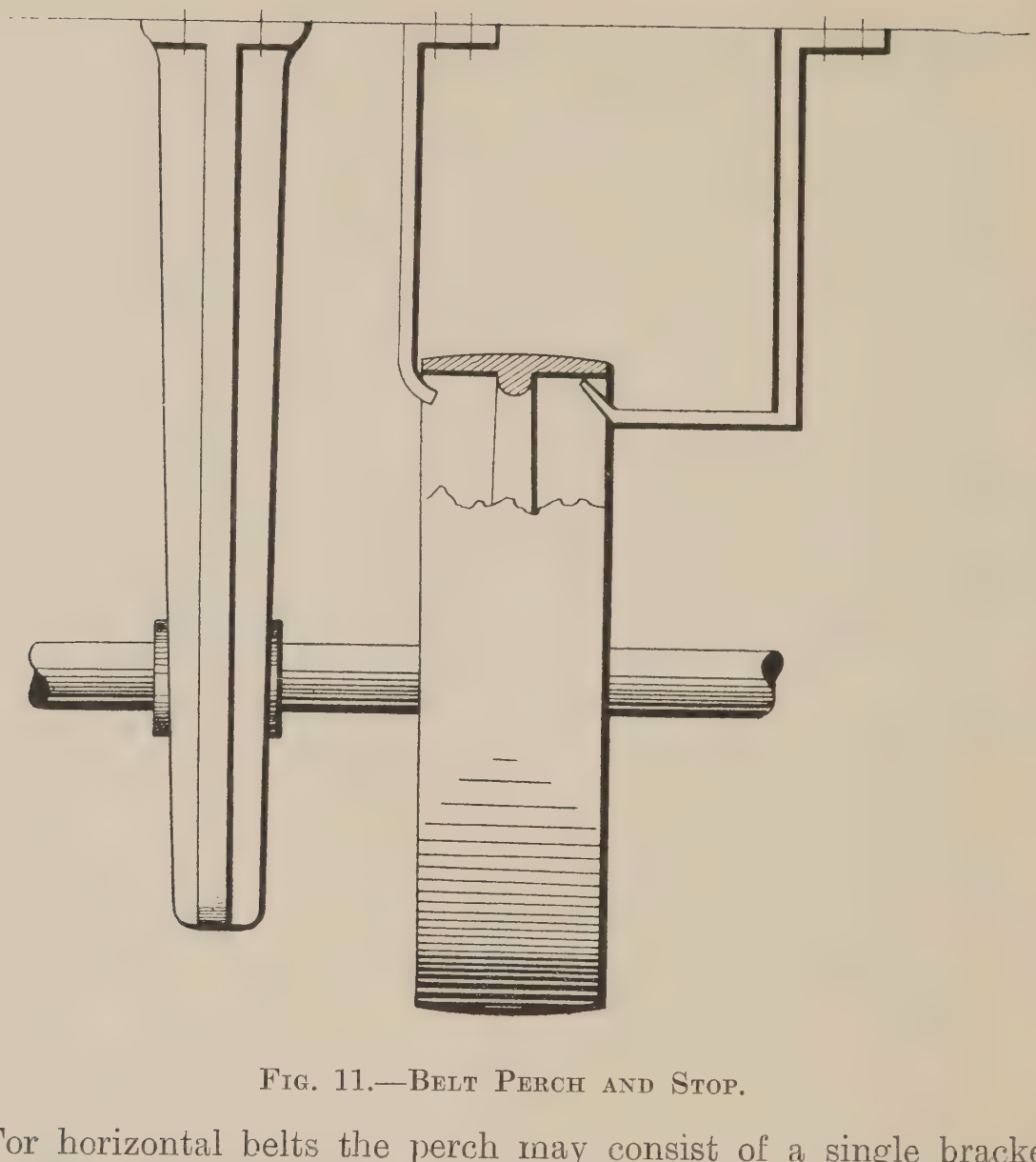


FIG. 11.—BELT PERCH AND STOP.

For horizontal belts the perch may consist of a single bracket provided with two pegs, *a*, *a* (Figure 12). If the belt is a lengthy one, similar pegs, *b*, *b*, placed at intervals, will afford adequate support for the entire belt.

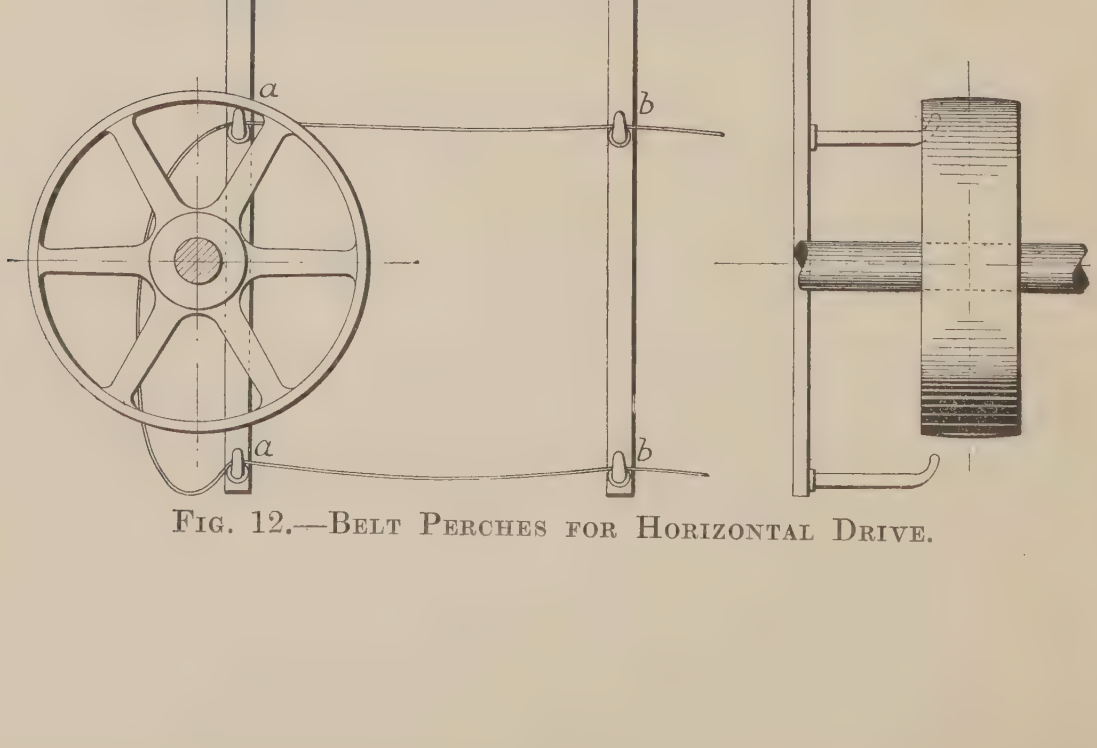


FIG. 12.—BELT PERCHES FOR HORIZONTAL DRIVE.

Although the simple belt perch may afford assistance in belt mounting, by supporting the dismounted belt close to the pulley rim, more direct assistance is obtained from the multiple peg type in which the belt is supported on a number of parallel pegs spaced on a curve eccentric with the pulley, the pegs being bolted to a curved bracket fixed beside it. The pegs are turned up under the pulley rim. The arrangement may be adapted to suit different directions and positions of the driving belts (Figures 13, A and B).

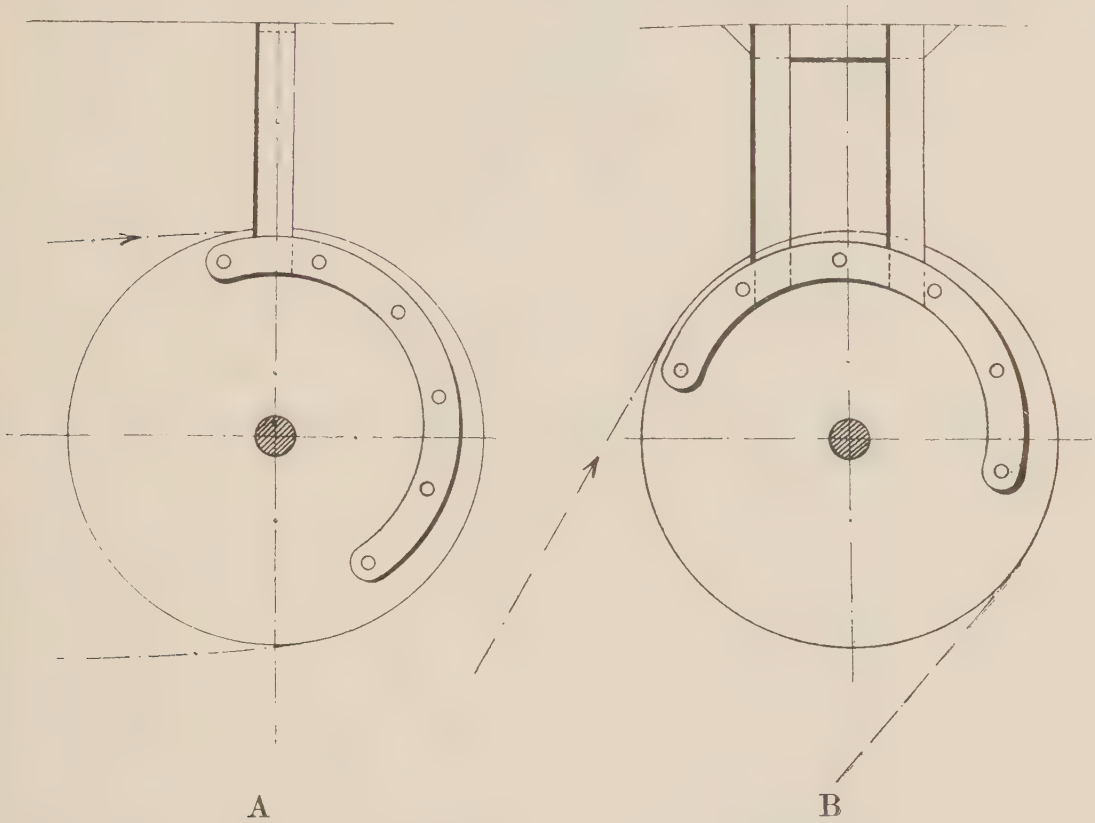


Fig. 13.—Multiple Peg Belt Perches.

This design was first introduced abroad by Biedermann, to serve as a belt mounter perch, and bears his name. For certain drives it has great utility, the belt being readily mounted by means of a belt pole. Its construction and use are described more fully in the section devoted to Belt Mounter Perches (p. 33).

A belt perch at floor level is a valuable safeguard where a machine belt, driven from overhead shafting on the floor below, passes through a single floor opening (Figure 14). The belt, when dismounted, is prevented from falling through the opening and lapping on the shaft.

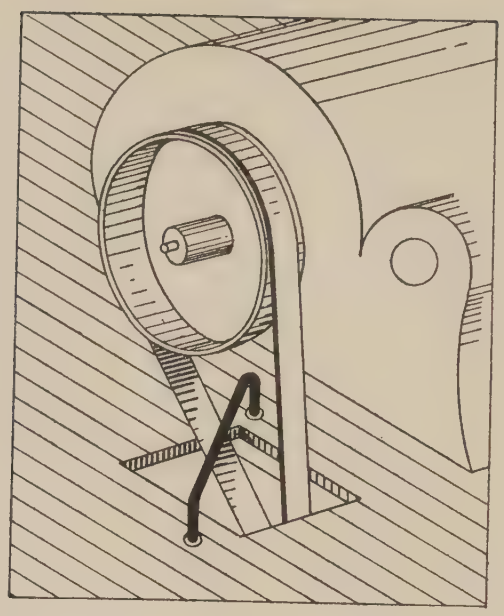


Fig. 14.—Belt Perch at Floor opening.
(Fencing of belt and pulley not shown.)

Belt Poles and other Portable Belt Mounters.—The various types of portable belt mounter include :—

(i) simple straight belt poles and belt sticks;

(ii) poles fitted with curved, flexible or jointed ends, designed specially for use in positions where it is impossible, inconvenient, or unsafe to use a straight pole.

Belt poles are used to a considerable extent in this country, but more so abroad where the flexible pole and the Biedermann belt mounter perch have been introduced more widely. Recently, as a result of increased attention to the dangers of belt mounting by hand, some British firms have found it possible to extend the use of poles in their factories, increased safety for the workers being thereby secured, together with saving of time.

Poles are chiefly used for mounting vertical or slightly inclined machine driving belts of moderate dimensions. Such belts seldom exceed 3 inches in width, and the height of the driving shaft does not, as a rule, exceed from 10 to 12 feet. Where a large number of more or less similar machines are installed (e.g., looms in weaving sheds), a suitable pole is a most useful appliance, one pole sufficing for many machines. Provided the belts are not unduly tight and the worker can place himself in a convenient and safe position, a well-trained man, by means of the pole, can mount the belt with ease. His position must be such that he is able to move the mounting end of the pole over a sufficient length of the contour of the pulley, from the point of intake where the belt runs on to the pulley.

Poles are also used for mounting light overhead horizontal belts, e.g., belts driving countershafts, but more skill and strength are required than for vertical or inclined belts. Many workers who are sufficiently expert with these belts may not possess the necessary confidence for dealing with horizontal drives.

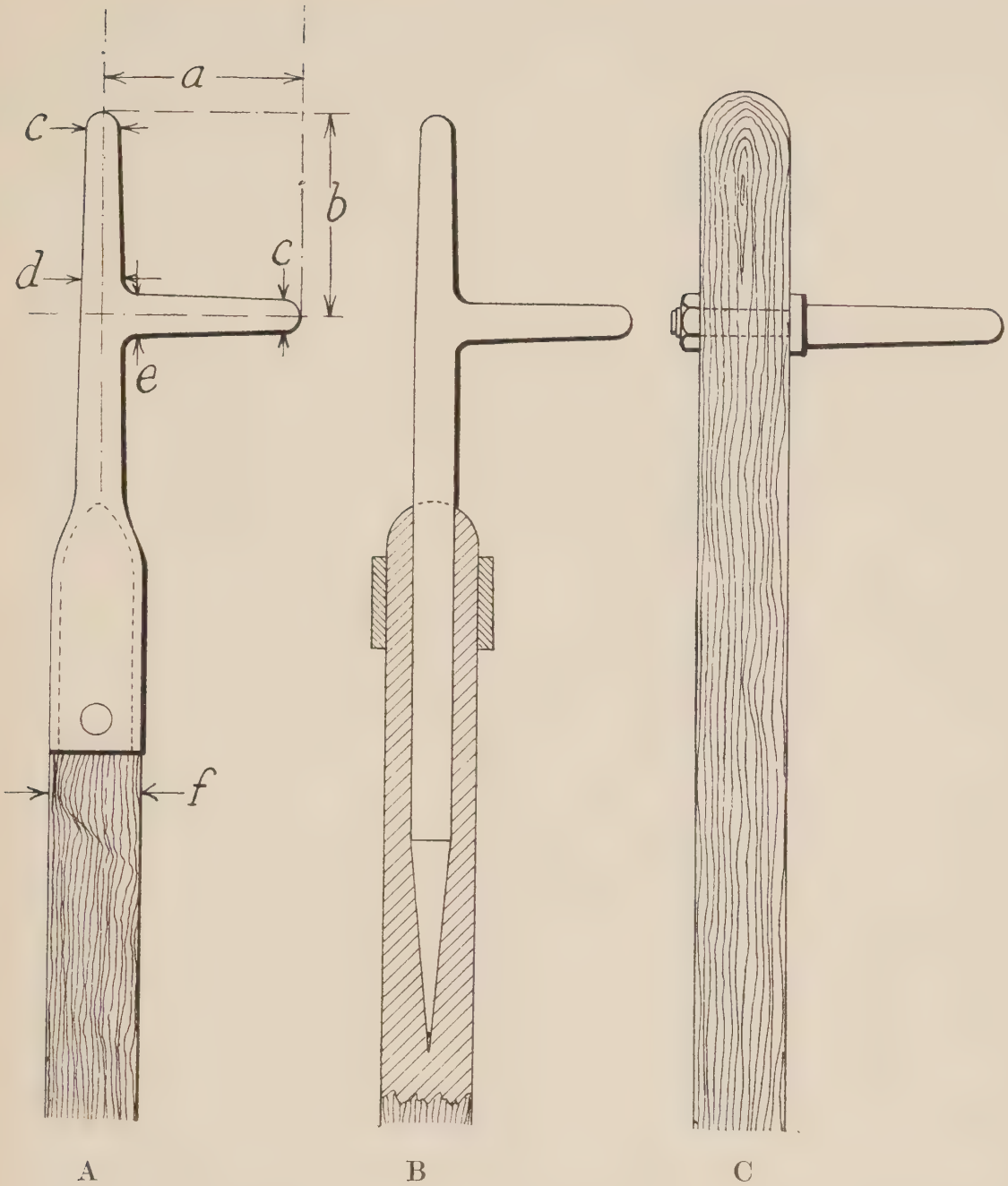


Fig. 15.—Hooked Belt Poles.

Some attention to the design of these comparatively simple appliances is necessary. Straight poles or sticks, selected haphazard, are sometimes used, which are not provided with a pin or other mounting device. They cannot be regarded as satisfactory, as the worker is not so well able to support the belt when he lifts it away from the shaft or perch.

The standard type of pole is the hooked pole, a strong straight and light wooden pole about $1\frac{1}{2}$ inches in diameter. It is fitted with a mounting pin of steel or wrought iron fixed about 3 inches from the end. This pin, about $\frac{1}{2}$ inch or $\frac{5}{8}$ inch in diameter, is straight but slightly tapered. It projects at right angles to the

pole about 3 inches (Figure 15, A, B, C.). Generally, the pin forms part of a forged tee-piece driven into the end of the pole and secured by a ferrule (Fig. 15, B). A parallel pin is sometimes used, but is not so satisfactory as the slightly tapered form.

The manner of using the pole for various drives in common use is shown in Figure 16, *a* to *f*, the dismounted belt resting on the shaft in each case, except that of the vertical up-drive, *e*.

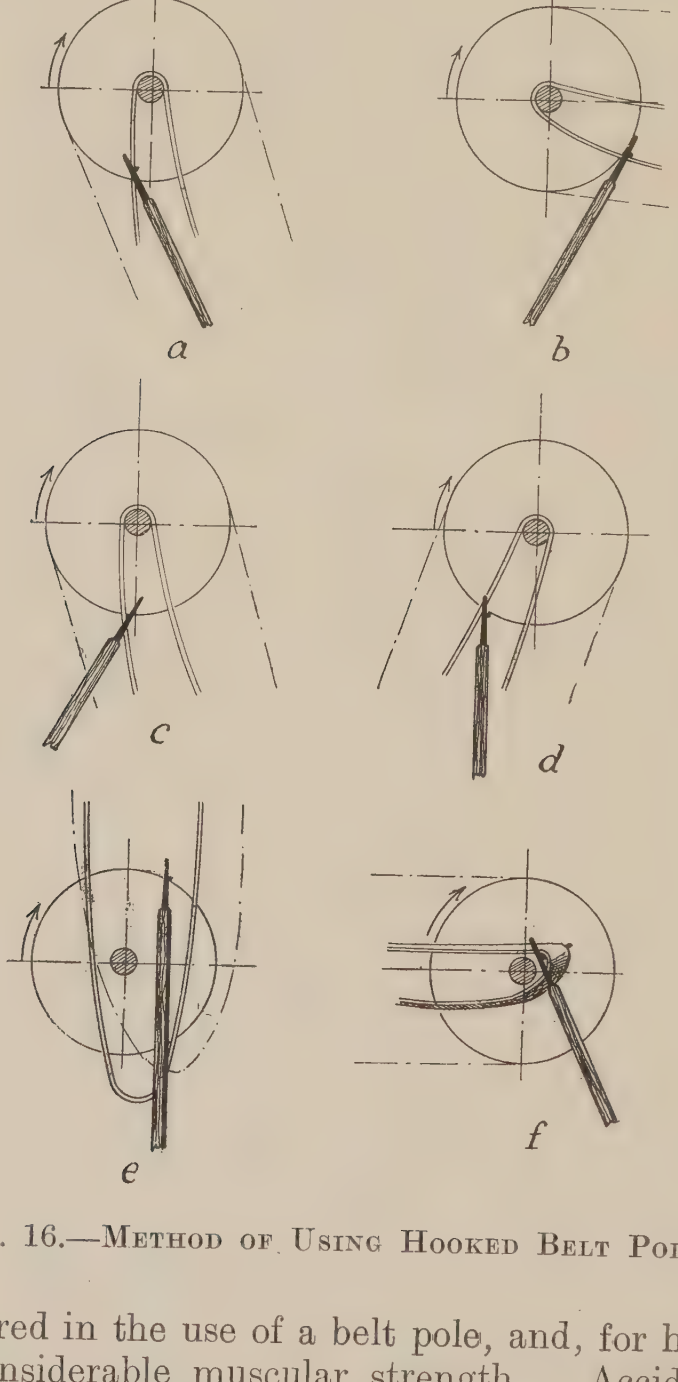


Fig. 16.—Method of Using Hooked Belt Pole.

Skill is required in the use of a belt pole, and, for heavy belts on high shafts, considerable muscular strength. Accidents may be occasioned through neglect of certain necessary precautions. The following are useful rules which should be observed:—

(1) Only trained men with good muscular development and vision should be permitted to use the poles, which should be under their direct care.

(2) The training should be gradual, i.e., the workmen should begin with small and comparatively slow-speed belts.

(3) The pole should be as light as possible consistent with adequate strength and length. Bamboo is successfully used for light belts, but ash is more commonly used for general service.

(4) The length of the pole should be but little less than the height of the shaft above the floor, so that the pole can be used as in Figure 17. The risk of the mounting pin catching in the pulley arms or between belt and pulley is thereby reduced, but, should this occur, the pole will not be driven against the workman's body, as is possible when a short pole is used (Figure 18).

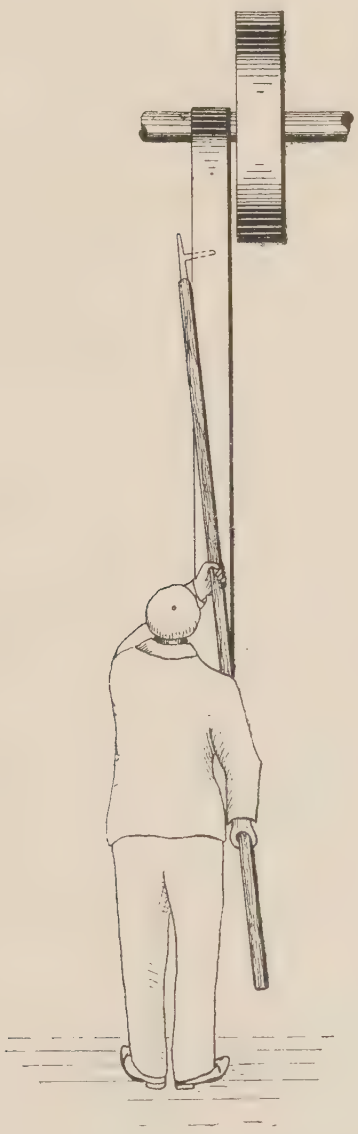


Fig. 17.

FIG. 18.
(Dangerously short pole—see page 17.)

(5) The workman should stand, if possible, at the side of the belt which moves towards the pulley with the pole between him and the pulley.

(6) The belt should be lifted on the mounting pin, which should then be moved to the point of intake, its end being there supported on the rim of the pulley. It should then be allowed to slide on the pulley in the direction of motion while the worker gradually pushes the belt into position with the end of the pole.

(7) The practice of introducing the mounting pin between the belt and the pulley rim, to permit the mounting movement to proceed over an unnecessarily large arc, should not be allowed, as the pole may be violently driven from the hands of the worker should it come into contact with the shaft, as must happen in many cases.

(8) Damaged poles should be repaired at once or discarded.

Simple belt sticks (Figure 19, *a* and *b*), have proved convenient in some cases for mounting open vertical or slightly inclined machine driving belts. The shoulder near the end takes the place of the mounting pin. These sticks are safer to handle than the hooked pole, but cannot be used for such a wide range of drives, e.g., in the case of crossed belt drives it is usually impossible to move the mounter end over a sufficient arc.

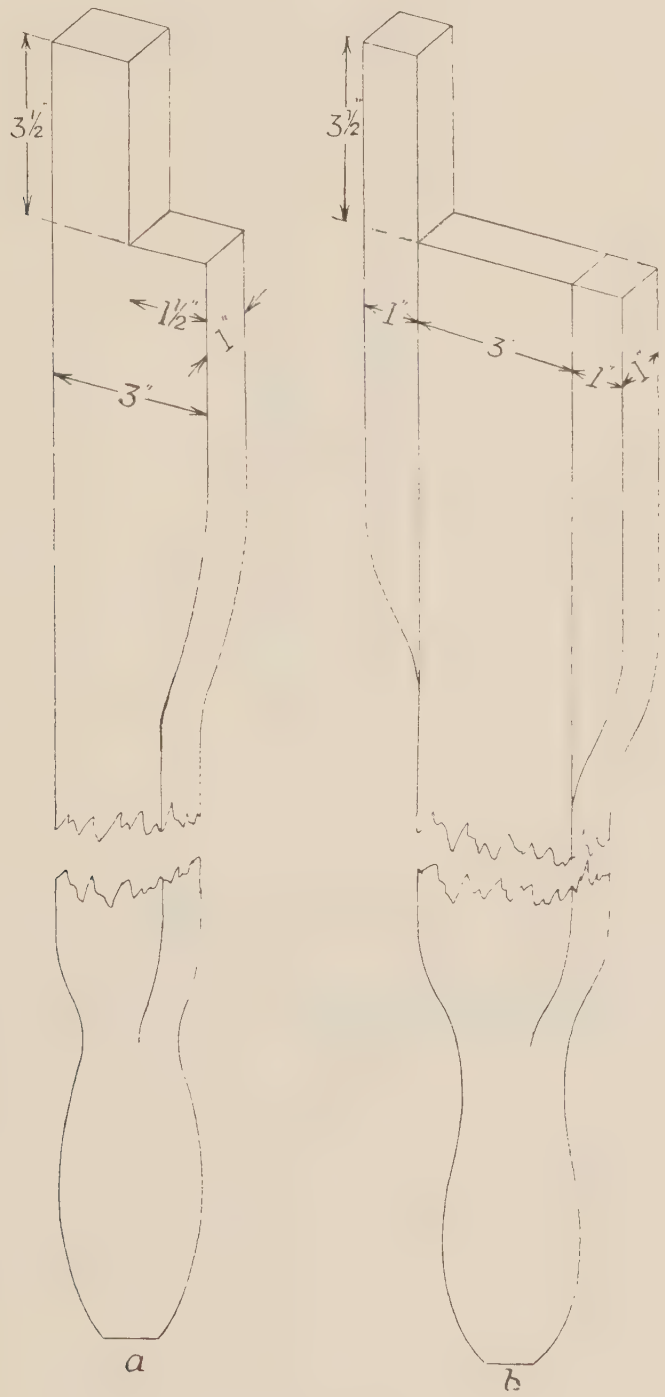


Fig. 19.

A straight pole, tapered on one side at the end (Figure 20), is probably the best type of pole for use at a vertical or slightly inclined drive provided with the Biedermann or multiple peg

mounter perch. A wide flat stick of section about 3 inches by 1 inch serves best for mounting the belt from a perch of the concentric type (p. 30).

Fig. 20.

Instead of the rigid mounter pin of the simple hooked pole, mounters capable of rotation have been introduced in certain cases. The Clipper or Klincha belt pole (Figure 21) is fitted with such a device, the mounter being supported in a bored socket piece, fitted at the end of the pole to which it is inclined. The free end of the mounter is forked, and the belt is supported between the jaws of the fork. The turning movement of which the mounter is capable enables the belt to accommodate itself readily to the pulley rim. The hooked stop under the larger jaw prevents the mounter being pushed too far sideways.

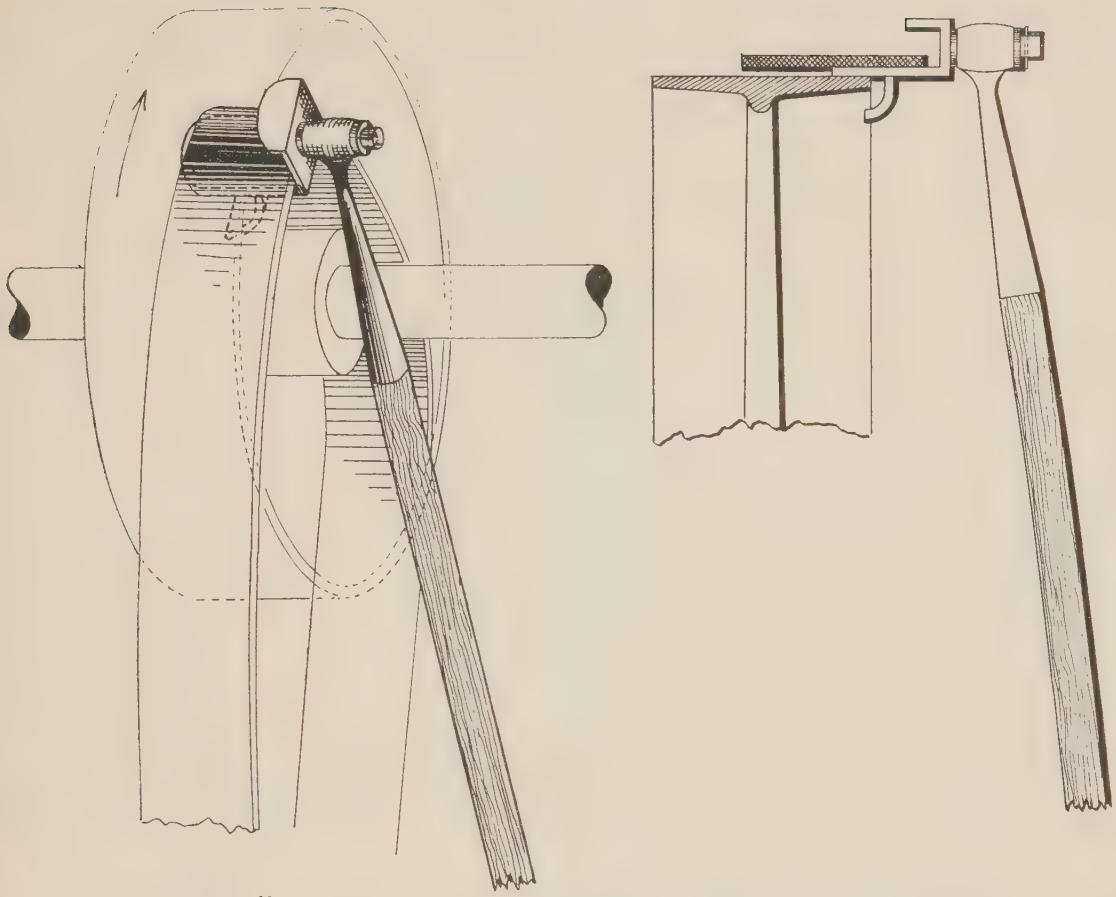


Fig. 21.—"Clipper" or "Klincha" Belt Pole Mounter.
(Messrs. W. T. Nicholson and Clipper Co., Ltd., King Street, Salford.)

Another rotary mounter pin—the Dulken—is shown in Figure 22.

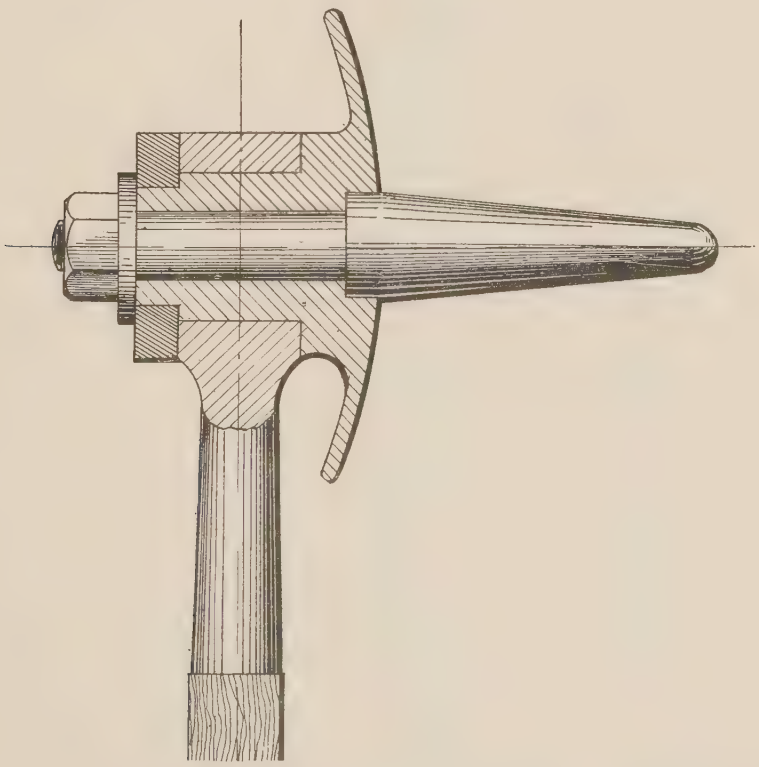


Fig. 22.—"Dulken" Rotary Mounter Pin for Belt Pole.

Cases arise where a straight pole cannot be used because the shaft or other obstacle prevents the pin or other mounting device

from being passed over a sufficient arc, which must usually be rather more than half the arc of contact of the mounted belt. The difficulty is greater with a crossed belt because of the greater arc of contact. Difficulties in the use of the straight pole may also arise because of the tension, length, height or direction of the belt to be mounted.

In some cases, these difficulties may be overcome by the use of poles with curved ends (Figure 23), or, better still, of poles fitted with special flexible or jointed mounting arms of suitable construction. The curved pole, of Italian design (Figure 24), is fitted at the end with mounting pins on both sides, these pins abutting against circular shield plates, which control the lateral movement of the pin. The dimensions given in the Figure are those recommended.

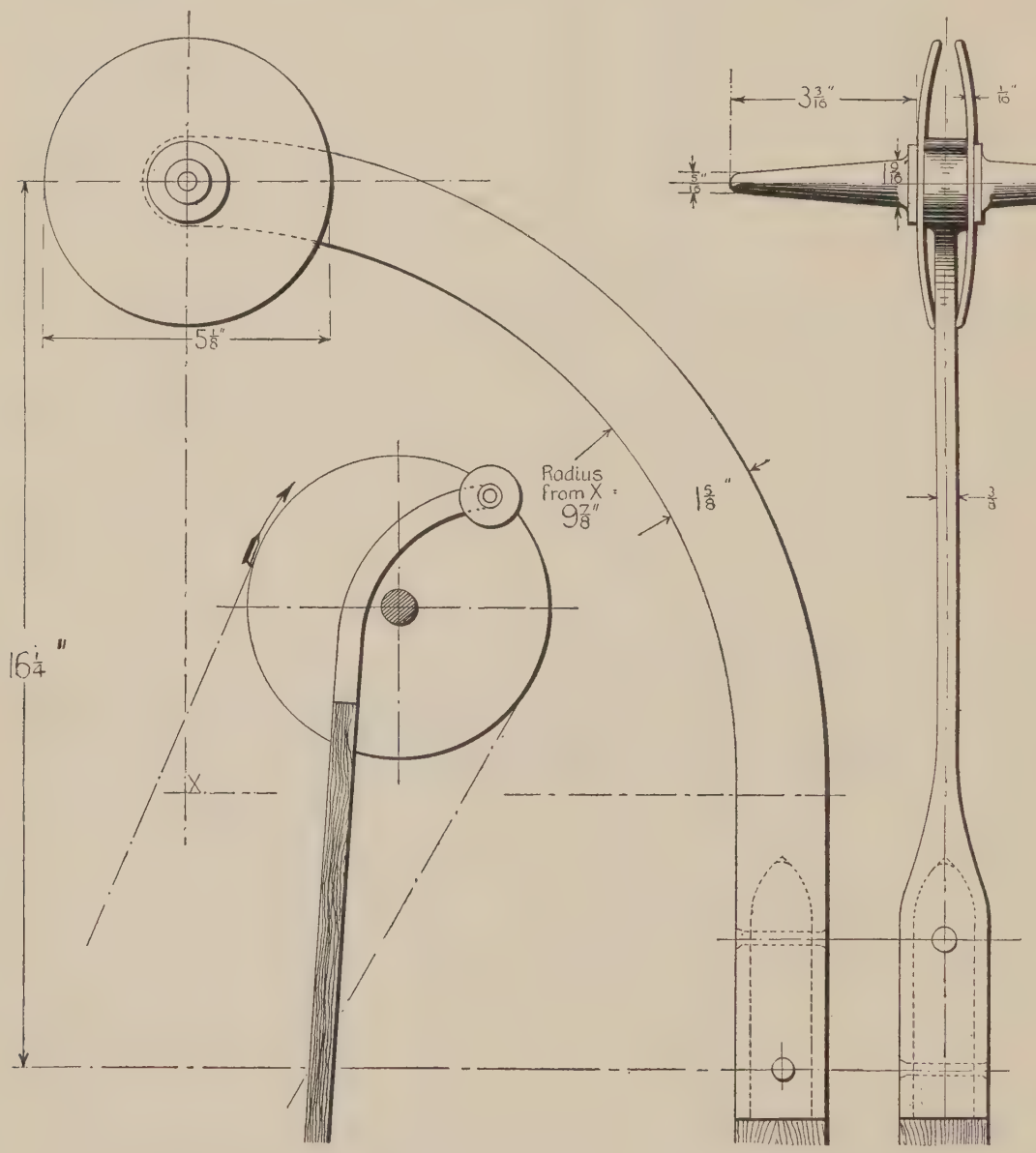


Fig. 23.—Use of Curved Belt Pole.

Fig. 24.—Mounter of Curved Belt Pole (Italian design).

Flexible and Jointed Belt Poles.—Many flexible and jointed belt poles have been invented, some being extremely ingenious. The Beck pole (Figure 25) is probably the best

known in this country, and its use appears to be extending. The flexible arm B, of square section, is supported from

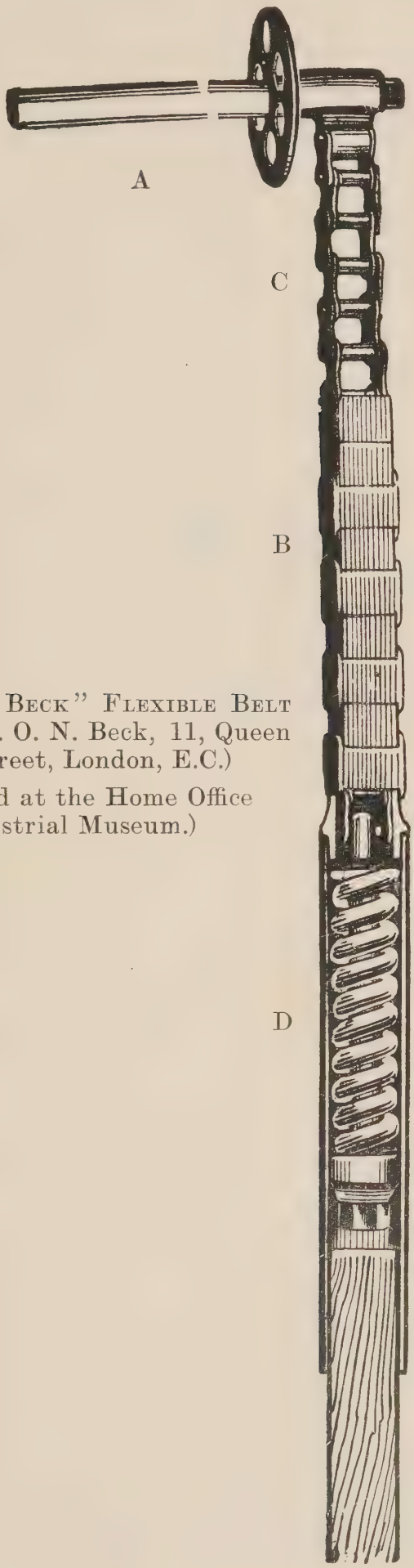


Fig. 25.—"Beck" Flexible Belt Pole. (Mr. O. N. Beck, 11, Queen Victoria Street, London, E.C.)

(Exhibited at the Home Office Industrial Museum.)

a tubular socket D, firmly secured to a strong pole, of pitch pine or ash, about $1\frac{1}{2}$ inches in diameter. The arm, which carries at its outer end the mounter pin A, is of articulated construction, consisting of 17 or 18 members, which form a flexible sheath enclosing the pitch chain C. This chain can be tightened to any desired extent by means of the strong spring in the socket, and the flexible arm thus given sufficient rigidity for the pole to act as a straight pole when the belt is first lifted and moved to the pulley rim. As soon as mounting begins, the strain of the belt, and the friction between the belt, pin and pulley rim, cause the arm to deflect and the pin to follow the belt round the pulley to the point where the former runs off. The arm, being then freed, straightens, regaining its rigidity.

The manner in which such a flexible pole avoids the obstruction offered by the shaft is shown in Figure 26.

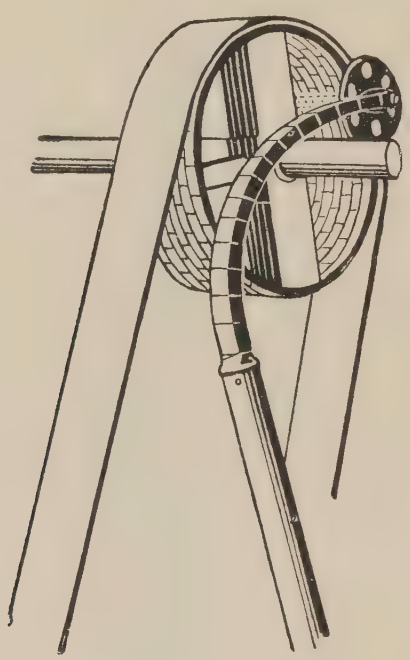


Fig. 26.

The strain on the spring can be regulated by an adjusting nut, so modifying the flexibility of the arm. In this way, the appliance, it is claimed, can be used for belts of widely varying tensions.

Of the many types of flexible or jointed belt poles which have been invented, only a proportion have proved reliable when used under practical conditions. This is perhaps not surprising having regard to the various requirements which such an appliance should satisfy, e.g., simplicity of construction, adequate strength combined with lightness, ease of manipulation, safety in use, wide range of action, reasonable cost.

Some years ago certain of the foreign Industrial Accident Prevention Associations organised public competitions with a view to stimulating the invention of more efficient portable belt mounters;

as a result many appliances were submitted for the consideration of the examiners. Their reports contain valuable information regarding the mounting of belts by means of poles, whether of the rigid or flexible type.

In the report of a competition held in France, particularly favourable mention was made of the Micault mounter, of which the following is a description :—

The Micault mounter is of the jointed type. Two designs are shown (Figures 27A and 27B). The curved jointed arm A, of flat section, which carries the mounter at its free end, is pivoted at the outer end of an iron socket B, this being firmly secured to a wooden pole of suitable length. The jointed arm can be folded or closed back on the fixed part much in the same way as the blade of a penknife is shut (Figures 27B and 28). The mounter has, therefore, a very wide range of action. The arm can be locked by a bolt (Figure 27A) or held by a spring (Figure 27B), the pole thus becoming a rigid curved pole.

The mounter is shown in detail at Figure 27A. The end of the flexible arm is provided with a short turned head which fits into the eye of the finger, two small stops preventing movement of the latter relatively to the head. The finger is fitted with a thin metal ferrule covered with indiarubber tubing, the ferrule being capable of turning freely on the finger.

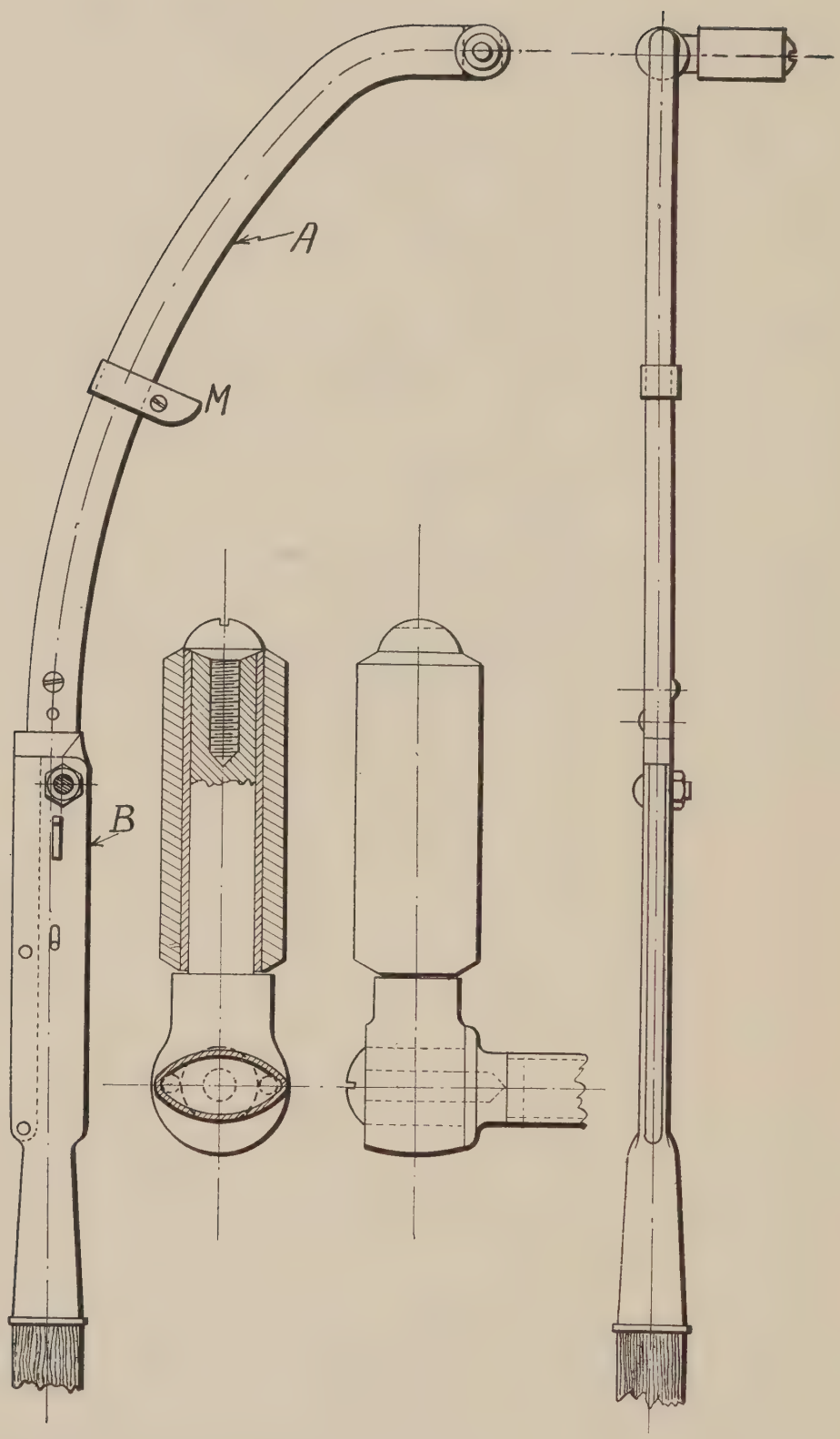


FIG. 27A.—"MICAULT" JOINTED BELT POLE (French Design).

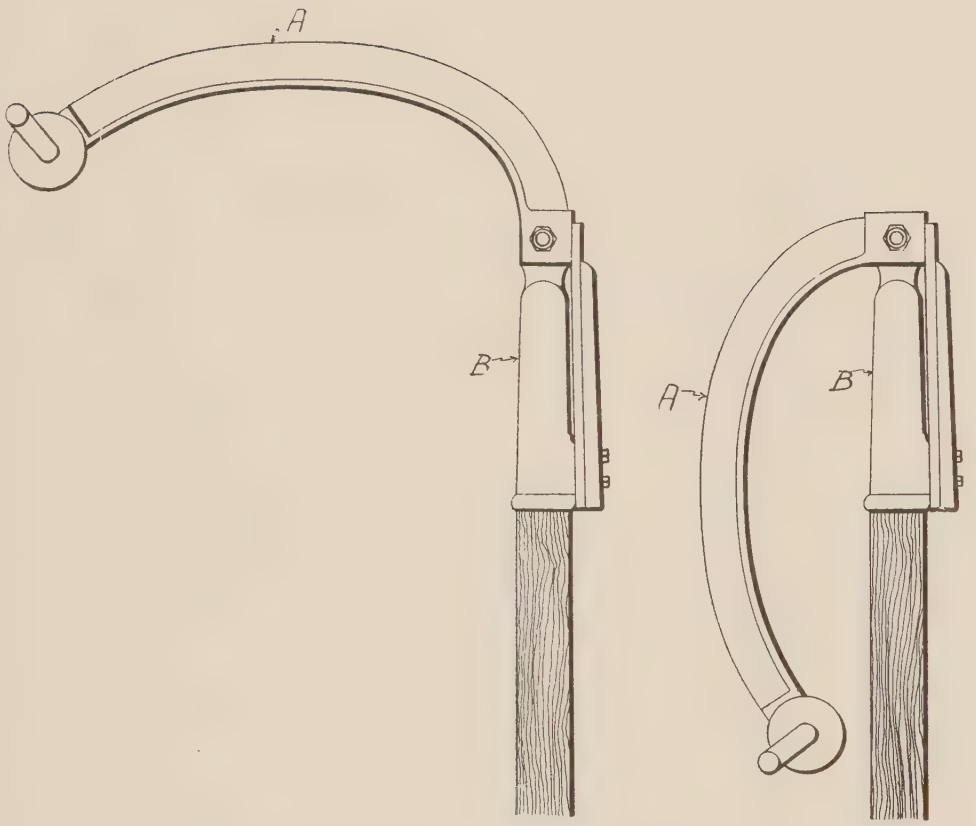
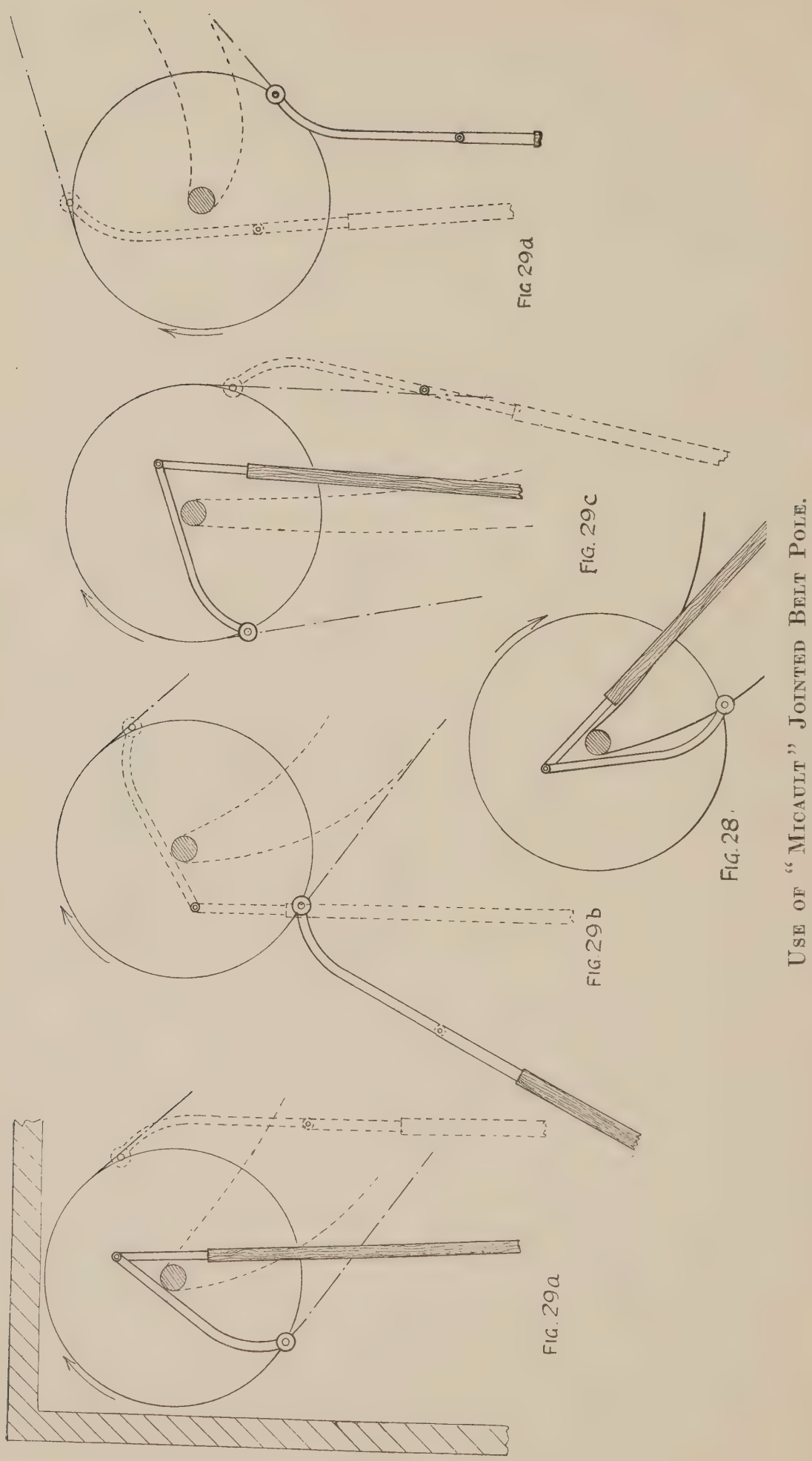


Fig. 27B.—"Micault" Jointed Belt Pole.



Use of "Micault" Jointed Belt Pole.

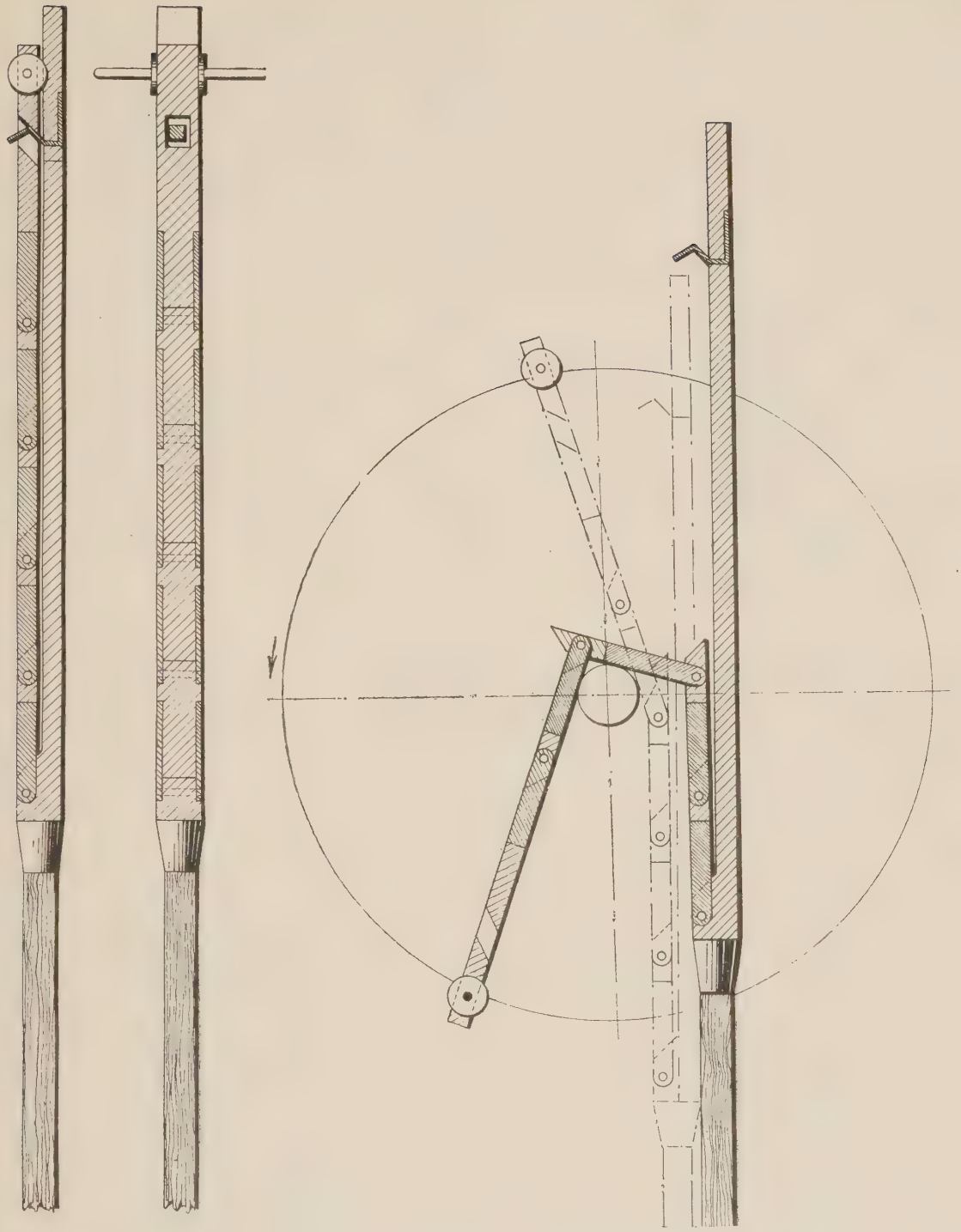


Fig. 30.—"Honold" Jointed Belt Pole (French Design).

The claw M, Figure 27A, forms part of a sheet-iron band which is firmly bolted to the flexible arm at any desired position. By its means the pole may be partially supported by the shaft.

Figure 28 shows the pole folded over the rotating shaft. The methods of using the apparatus for mounting belts at various drives are shown diagrammatically at Figures 29A to 29D. The full lines indicate the commencement and the dotted lines the completion of the operation. The mounter, as in the case of the Beck pole, is carried round the arc of contact by engagement between belt and pulley.

In cases B and D, the pole is " open " when commencing the mounting. The wide range of action possible is clearly shown in the case of the drive at A, which is in all respects similar to that at B, except that the pulley in the former case is close up to the angle between wall and ceiling. A workman, provided only with a straight pole, would not succeed in mounting the belt in this case, as he could not place himself in a suitable position. The flexible pole eliminates the difficulty. As a preliminary, the pole is first " folded."

The Honold pole (Figure 30) is also of jointed type. The upper part is divided into two parts in the direction of its length. One part is rigid with the wooden pole, the other which carries the mounting finger is of articulated construction, being formed of a number of jointed sections which can be closed up or unfolded as shown. The jointed part when closed up is held to the fixed part by means of a spring.

In mounting, the belt is first seized by the finger of the closed-up pole, which is brought to the pulley rim at the point of intake where the finger is engaged between belt and pulley. Movement results, and, as soon as the rigidity of the pole becomes an obstacle to the continuance of the movement, the flexible part gradually unfolds until the mounting is completed.

Belt Mounter Perches.—Simple types of belt perches have been designed which, while providing the necessary safe support for the dismounted belt, afford special assistance to the worker when replacing the belt with a pole or stick. These perches are therefore conveniently referred to as belt mounter perches. The belt support provided is either concentric or eccentric with the pulley. These appliances are inexpensive.

The concentric perch is usually a wooden block of the same radius as that of the pulley, the belt support being co-extensive with a sufficient length of the arc of contact of the mounted belt. This perch has been successfully used for vertical and slightly inclined machine belts. For a short, slack, vertical belt the arc of the perch may extend almost to a semi-circle (Figure 31), but for long, tight belts, the back of the perch may require to be cut away to some extent to give sufficient " slack " to the dismounted belt. For this reason also the arc is much more reduced for inclined drives. In Figure 32, which is drawn to scale, the angle subtended at the centre is about 95°. The forward edge of this perch is displaced in the direction of motion beyond the point of intake, and the front of the perch rounded or " nosed " as shown. These details are of advantage in the mounting operation. The belt in this case is readily mounted by a flat stick, 3 inches by 1 inch is a convenient size.

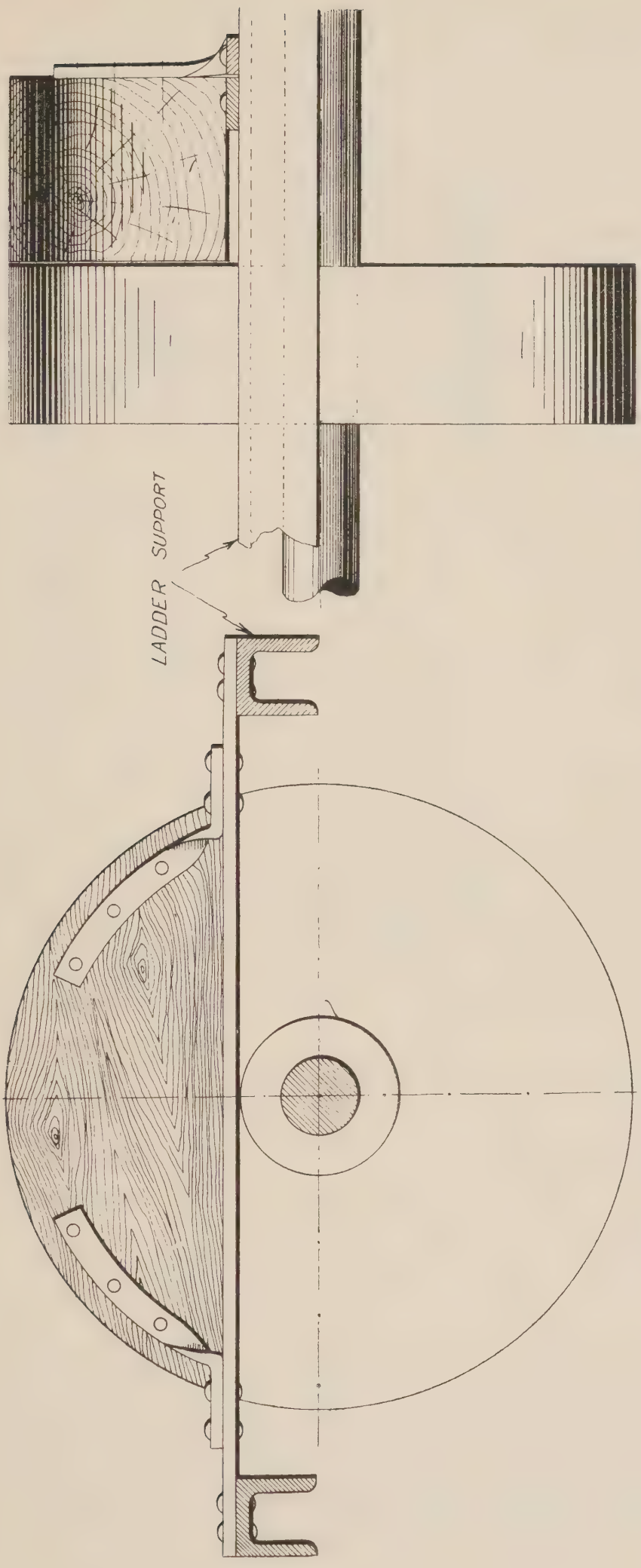


FIG. 31.—CONCENTRIC BLOCK BELT PERCH FOR VERTICAL DRIVE.
(Exhibited at the Home Office Industrial Museum.)

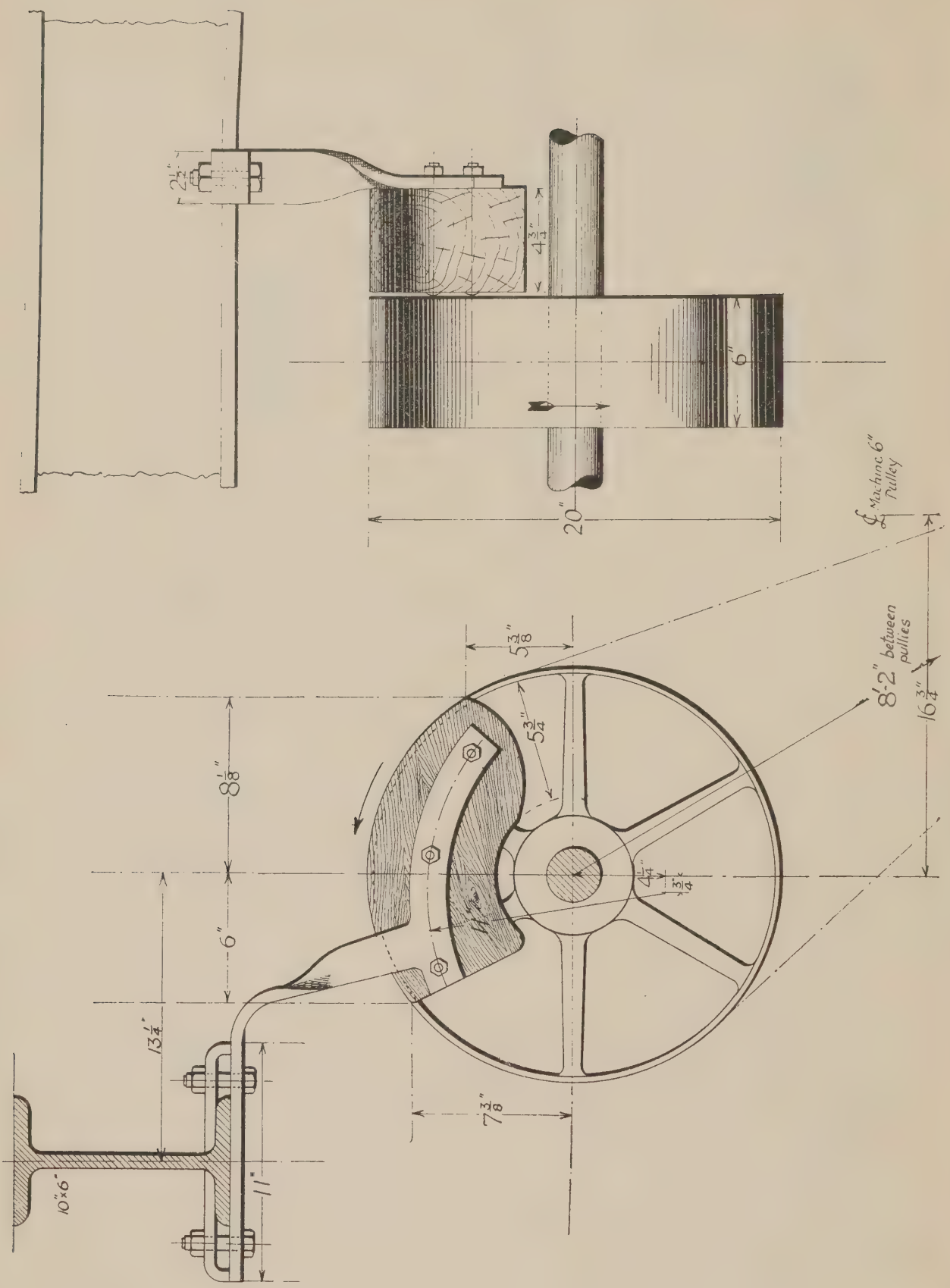


FIG. 32.—CONCENTRIC BLOCK BELT PERCH FOR INCLINED DRIVE.
(Exhibited at the Home Office Industrial Museum.)

These perches must be placed close to the pulley so that it is impossible for the belt to slip between, and they must be firmly and rigidly secured to well-supported brackets or other substantial support, so that all movement is prevented. The perch in Figure 31 is supported on rails placed parallel to the shaft. The rails afford the necessary support for a series of perches.

Biedermann Belt Mounter Perch.—The Biedermann perch (Figure 33) is a multiple peg perch designed to afford the greatest possible assistance in the mounting of the belt (see p. 13).

The dismounted belt is supported by the line of pegs, which are arranged at intervals on a circular arc eccentric with the pulley.

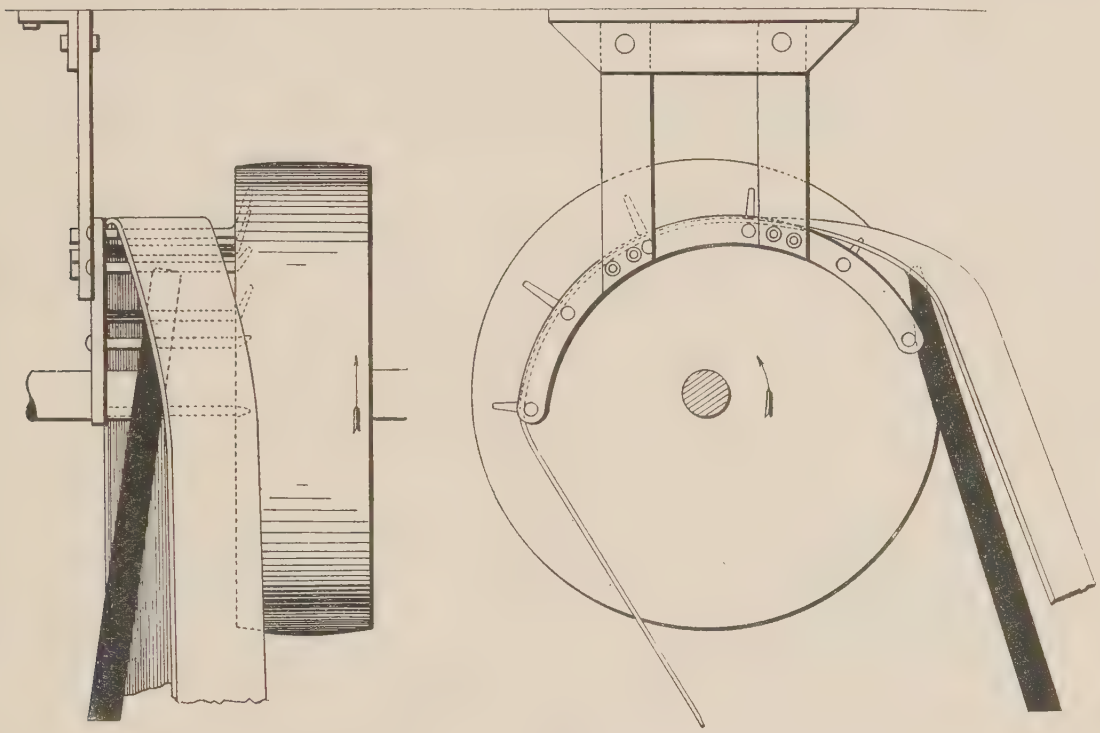


FIG. 33.—"BIEDERMANN" MULTIPLE PEG BELT PERCH.

The suggested layout of this curve relatively to the pulley circle is shown in Figure 34. The arc is struck with a radius of 0.8 to 0.85 that of the pulley. Its centre is found by the following construction. The configuration of the mounted belt is first drawn, from which the extreme points of contact of the belt with the pulley are obtained, X (point of intake) and Y (point of offset).

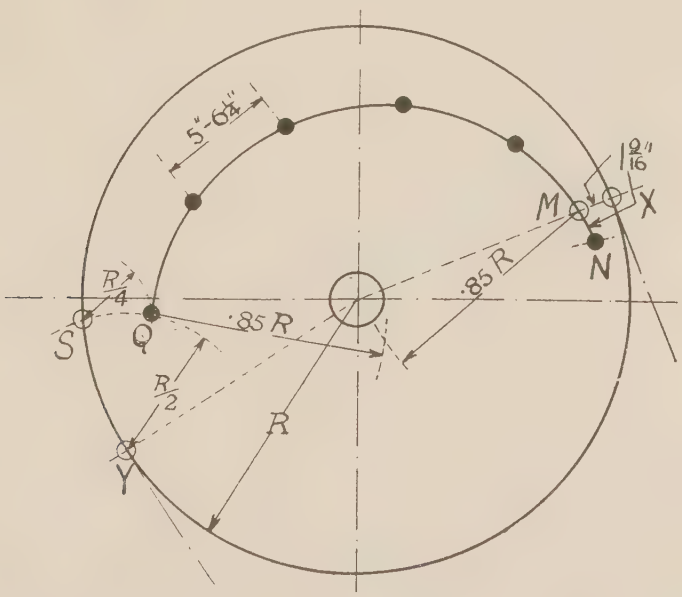


FIG. 34.—DESIGN FOR "BIEDERMANN" MULTIPLE PEG BELT PERCH.

From X a distance of $1\frac{9}{16}$ inch is marked off on the radius OX, giving point M on the curve. With centre Y and a radius one-half that of the pulley an arc is struck opposite to the direction of motion intersecting the pulley circle at point S. With centre S a second arc is struck of one-fourth the pulley radius intersecting the first arc in Q. This is the correct position for the last peg. The peg circle is then drawn through the points M and Q. The position of the first peg N is found at a distance $1\frac{9}{16}$ inch from M, measured in the direction of the driven pulley. The pegs should be equally spaced on the arc QMN at distances varying from 5 to $6\frac{1}{4}$ inches.

The sector which carries the pins must be very securely and rigidly fixed to the ceiling beams, or other support, so that when the moving belt is dismounted and falls on the pegs displacement will not take place. This is of particular importance in the case of tight, heavy, high speed belts. In certain cases it may be desirable slightly to decrease speed before dismounting.

The pins, usually made of round iron, should pass about $\frac{3}{4}$ inch under the rim, the ends being turned up at 45 degrees. The height of the turned-up ends may with advantage be progressively increased as the distances of the pegs from the pulley rim increase, so that each point almost touches the rim. This will facilitate

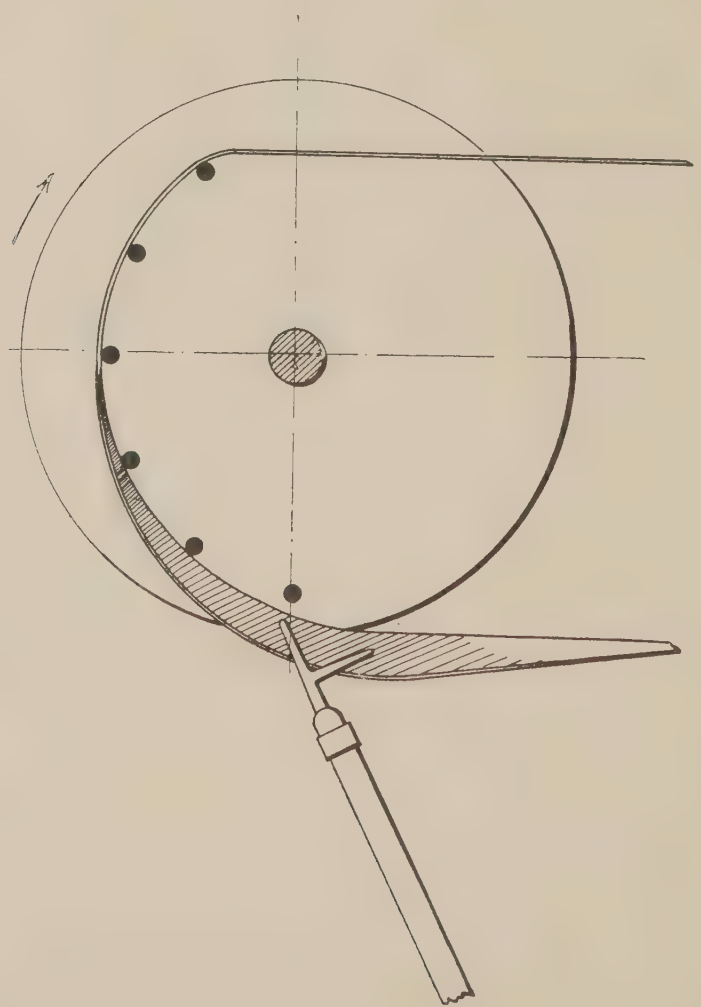


Fig. 35.

the fixing of the apparatus, and the more effectively prevent the belt from coming into contact with the pulley. If the pulley is of small diameter, a curved plate should be used instead of the pins. A method of varying the adjustment of the pins is sometimes introduced, the sector carrying the pins being fixed on a cast-iron support provided with a slide so that it can be moved and the best position found by trial.

The Biedermann mounter may be used for vertical and inclined drives and for overhead horizontal drives in which the direction of motion of the belt on the driving pulley is upwards (Figure 35). A straight pole, tapered at the end (Figure 20), is recommended for mounting vertical or inclined belts, but the hooked pole is necessary for the overhead horizontal drive. The twin Biedermann perch (Figure 36) serves for two pulleys mounted close together.

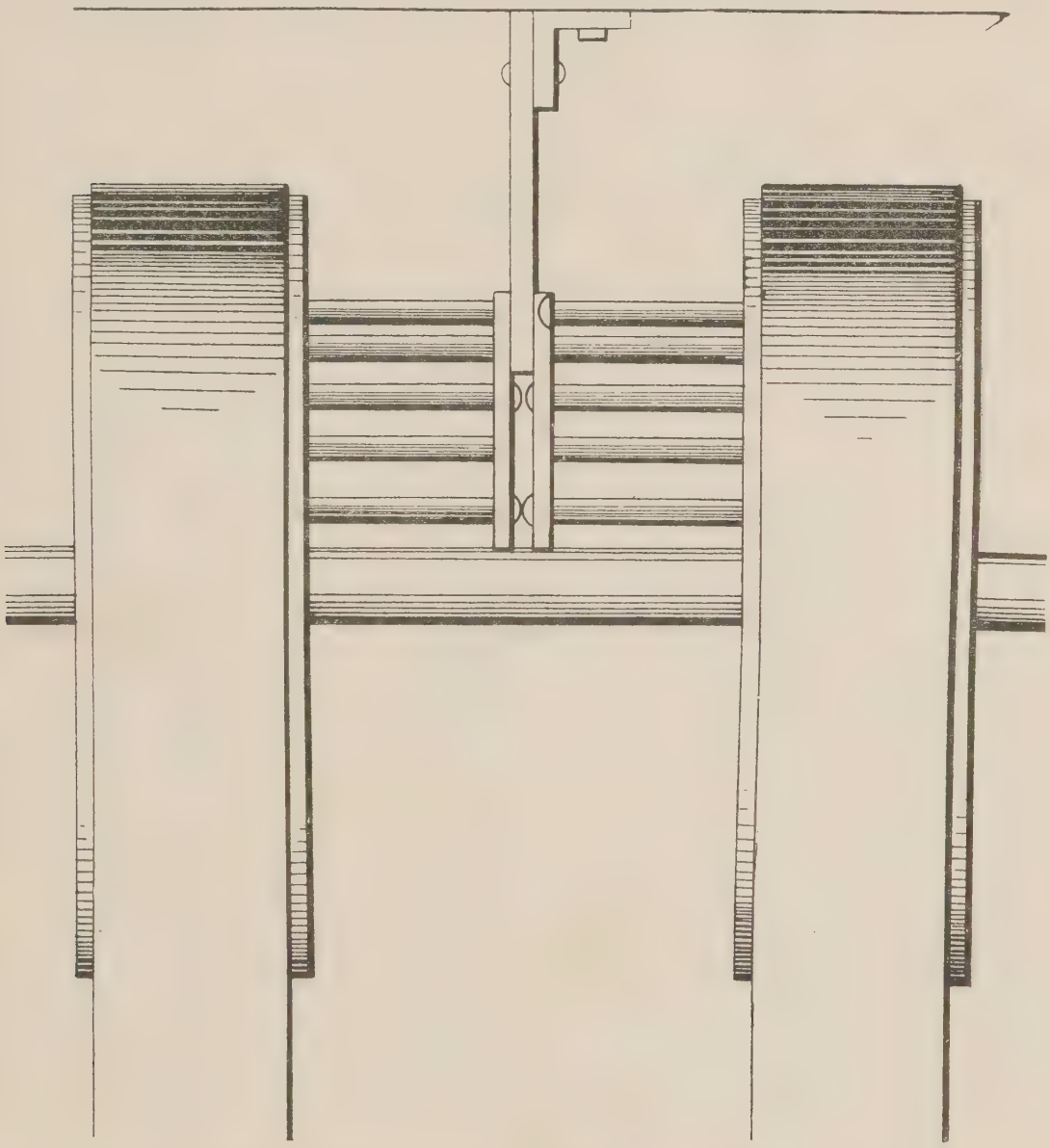


FIG. 36.—TWIN "BIEDERMANN" MULTIPLE PEG BELT PERCH.

Mechanical Belt Mounters.—A mechanical belt mounter is an appliance permanently installed beside the driving pulley, which, in addition to providing the necessary perch or support for the dismounted belt, is also furnished with the mechanism for replacing it. Such mounters, if carefully

designed and installed, can deal with larger belts of higher speed and greater tension than can be conveniently and safely handled with belt poles. They can be operated also in positions where poles are impracticable. They have therefore special application to those cases where the devices previously described may not be suitable and where it may be undesirable or extremely difficult to arrange for the stopping or slowing down of the transmission machinery. Even in cases where poles are practicable, these appliances are sometimes preferred because they afford means which are always at hand for mounting the belts and, moreover, risk of accident arising from misuse of the pole is eliminated.

Mechanical mounters have, hitherto, not received the degree of attention in British industrial circles which they merit, although signs are not wanting that this attitude is giving way to one of greater interest. These appliances are sometimes objected to on the ground that they are complicated and expensive. Some simple types have, however, been designed, to which these objections cannot be made. Even in the case of the more expensive appliances, it must be remembered that, in addition to their importance from the safety point of view, they may, in certain circumstances, be valuable time savers.

Broadly speaking, the various mechanical belt mounters which have been designed may be divided into two groups. The first includes all designs in which the belt is pushed into position from the perch by a lateral movement of the mounting finger or other device, the second, those in which the mounting is accomplished by imparting a rotary movement to an arm, or arms, or other mounter device. These groups are distinguished below as laterally-operated and rotary mounters, respectively.

Laterally-operated Mechanical Mounters.—The perches provided with these mounters are either of the concentric type (p. 30) or of the Biedermann or multiple peg type (p. 33). The mounters are, in effect, developments from these types of perches.

A simple mounter with a concentric perch, made in this country, is known as the " Security " (Fig. 37). The perch, which is slightly more than half the periphery of the pulley in length, consists of two parts, the rear portion (shown at the front of the illustration) being the aluminium plate E, of the same radius as the pulley and extending over about a quarter of its periphery. The front of the perch consists of a series of adjustable horizontal studs, each of which carries a free wooden roller, the lowest roller being shown at F. The mounting or dismounting of the belt is performed by the rotation of the hand wheel shaft G (operated at a convenient position from floor level) which causes the mounting finger (connected to K) or the dismounting finger (connected to J and L) to move the belt laterally from perch to pulley or pulley to perch respectively, as required. The fixing brackets, A, B, C, carry the whole of the belt mounting mechanism. This appliance is successfully used with light vertical or inclined machine belts. The dismounting finger prevents the belt from being dismounted on the side opposite the perch.

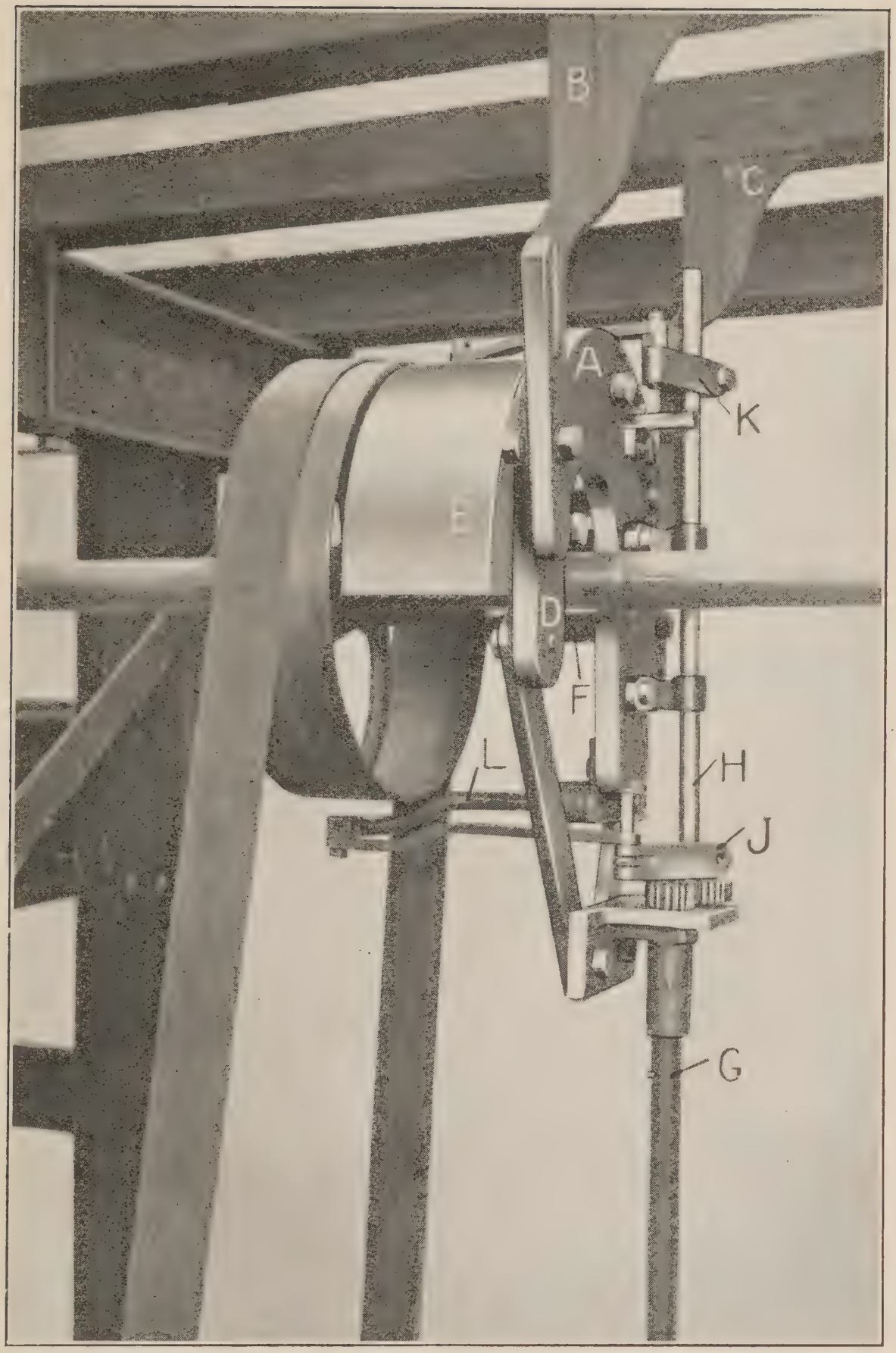


FIG. 37.—"SECURITY" BELT MOUNTER.

(By courtesy of "Machinery.")

(Mr. J. Broughton, "Security" Works, Vere Street, Birmingham.)

(Exhibited at the Home Office Industrial Museum.)

A foreign design for a concentric perch mounter is shown in Figure 38. A fixed segmental perch, made of sheet metal, of

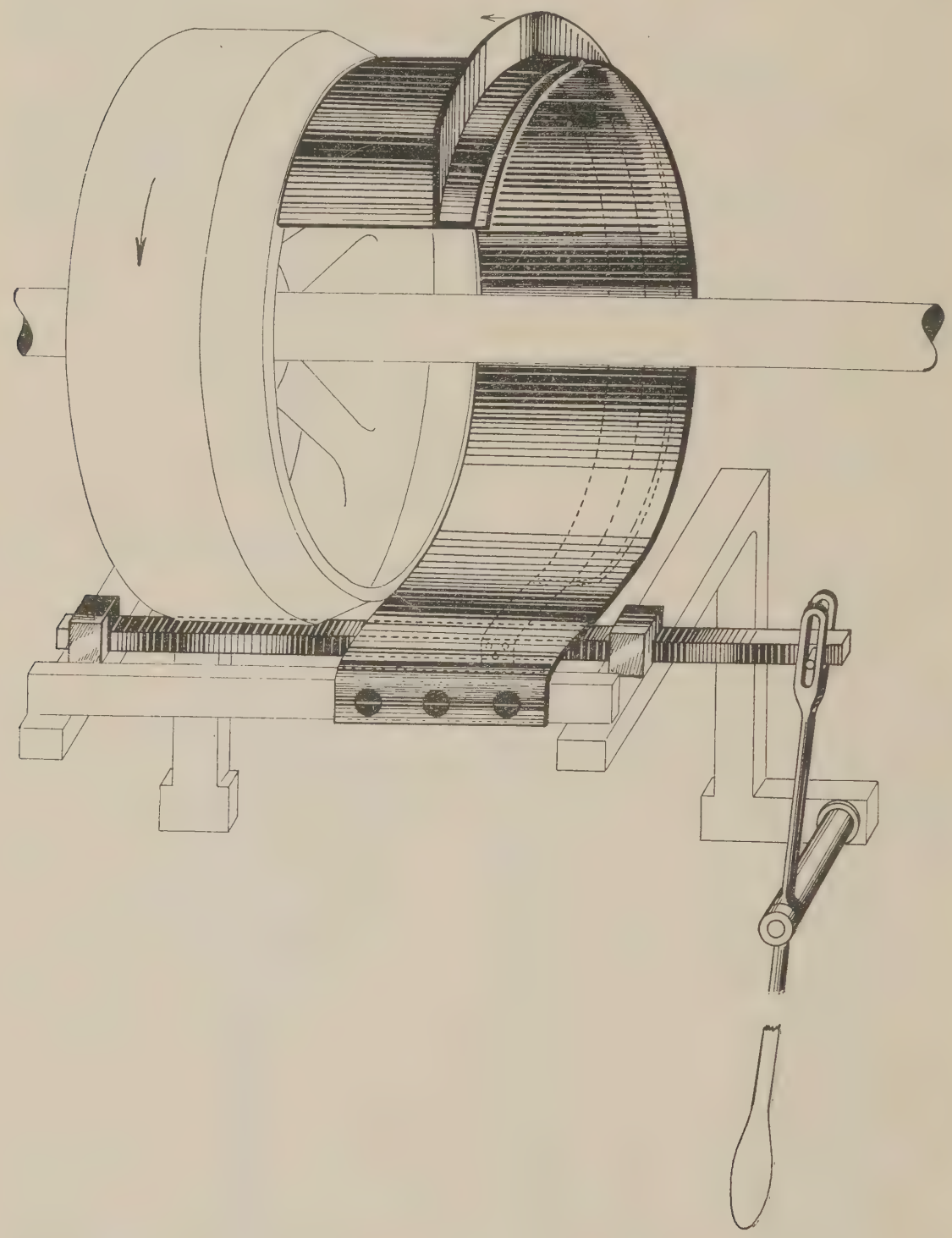


FIG. 38.—BELT MOUNTER WITH MOUNTING SLIDE (German design).

somewhat smaller radius than the pulley, supports a fixed concentric slide which pushes the dismounted belt into position when moved towards the pulley. This lateral movement is effected much in the same way as an ordinary belt fork striking gear. The pulley (or perch) is coned or bevelled, as shown, to assist the mounting operation.

Another foreign mounter fitted with a multiple peg perch is shown, Figure 39, applied to an overhead drive.

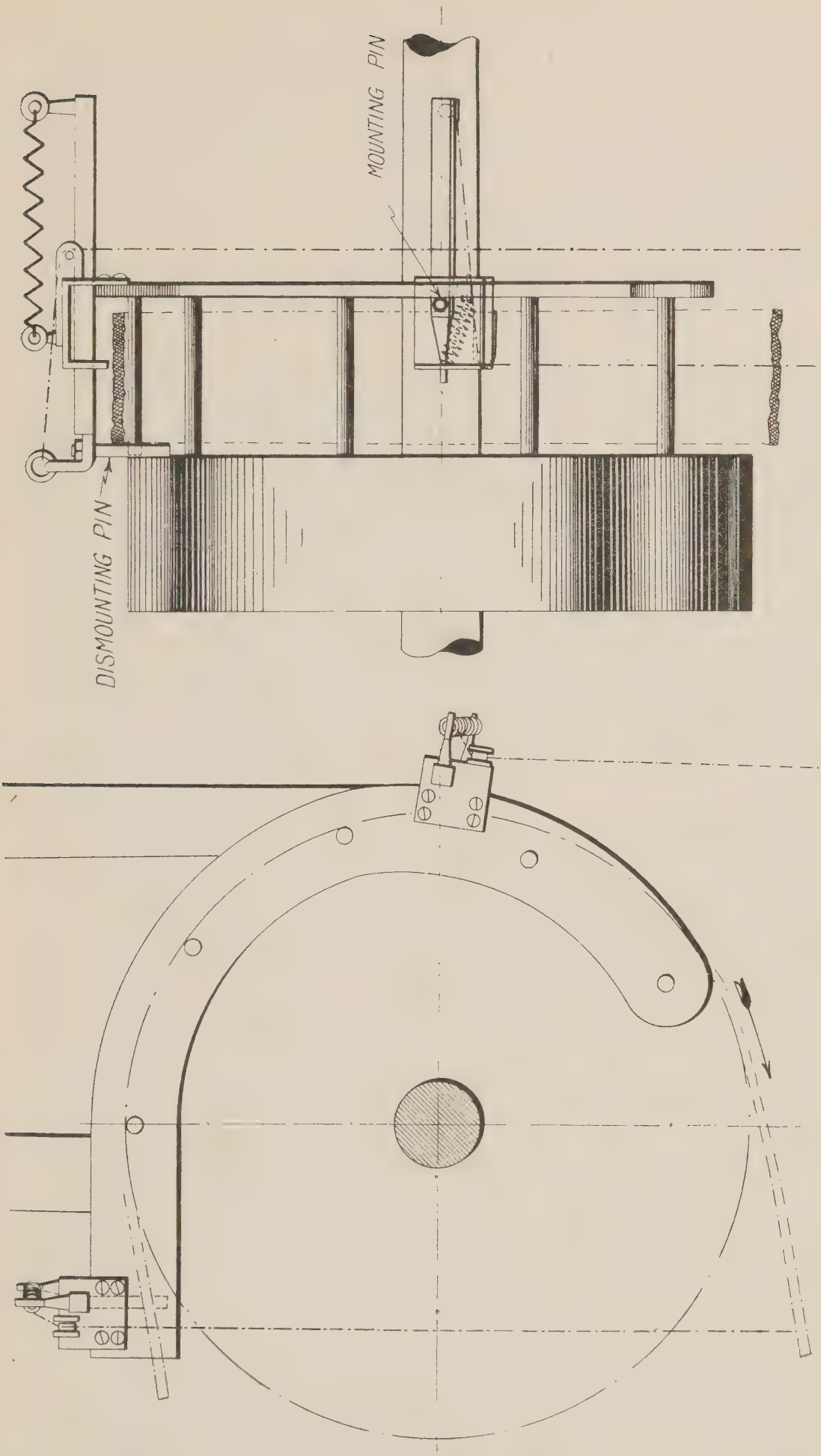


FIG. 39.—BELT MOUNTER WITH SPRING-CONTROLLED MOUNTING FINGER.

The mounting finger moves in the space between two pegs of the perch, and, as in the case of the "Security" mounter, is so placed as to operate on the belt near the middle of the arc of contact. A dismounting finger is fitted near the point of intake. The two fingers are moved by means of hanging chains, and are

restored to their " rest " positions, when the controlling chains are released, by the action of suitable springs.

For the mounting of wide, heavy belts on large fast-moving pulleys, a series of mounting fingers may be required to push the belt into position. The movement of these fingers is secured by a pull on a rope or chain, so that they must be linked together in a suitable way. This is successfully accomplished in a British mounter of which one design is shown at Figures 40, A, B, C, and in foreign mounters of somewhat similar construction, e.g., the Heurtier-Piat, a French design. These appliances usually embody a dismounting finger.

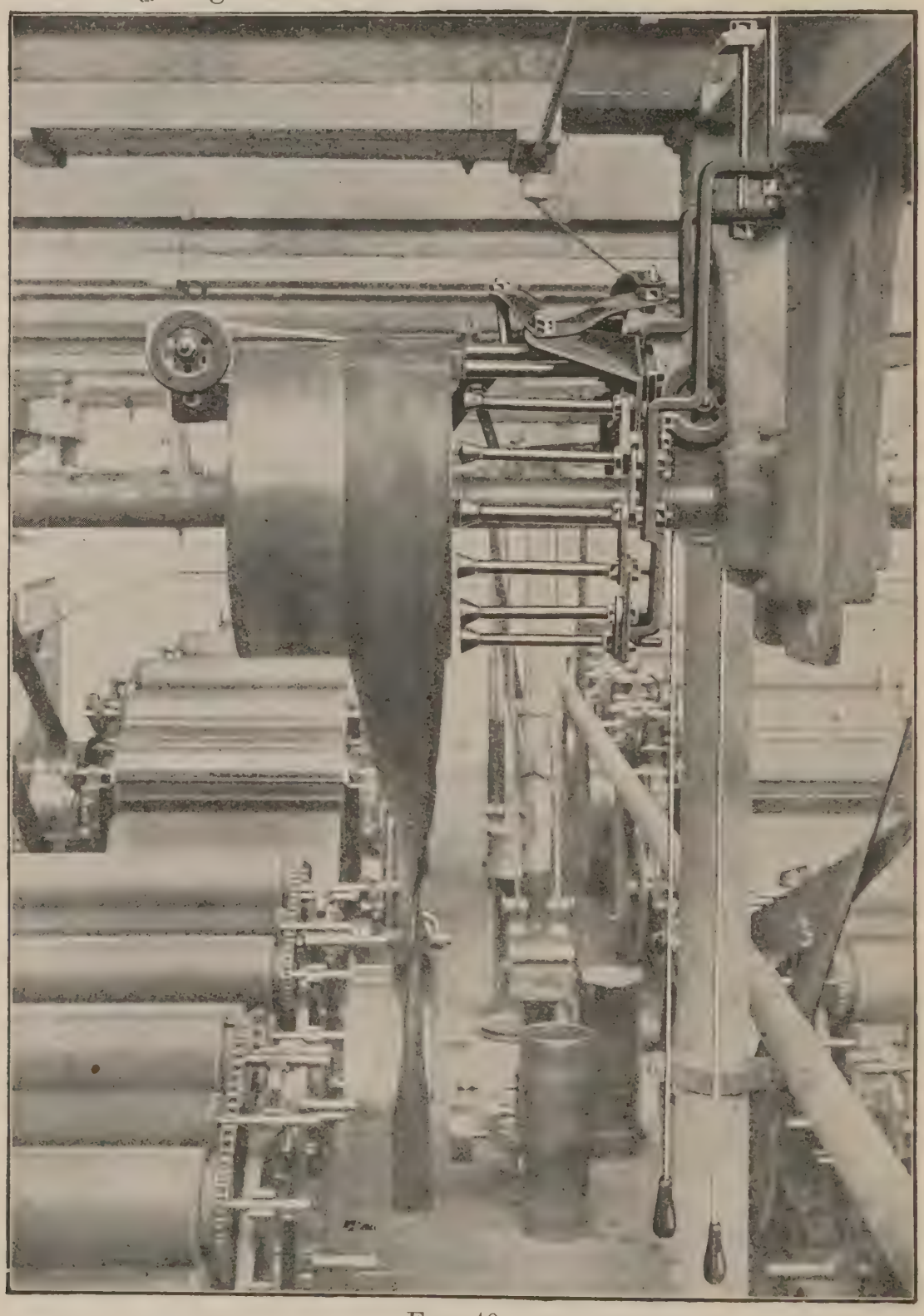


Fig. 40A.
(Messrs. Frank Wigglesworth & Co., Ltd., Shipley).
(Exhibited at the Home Office Industrial Museum.)

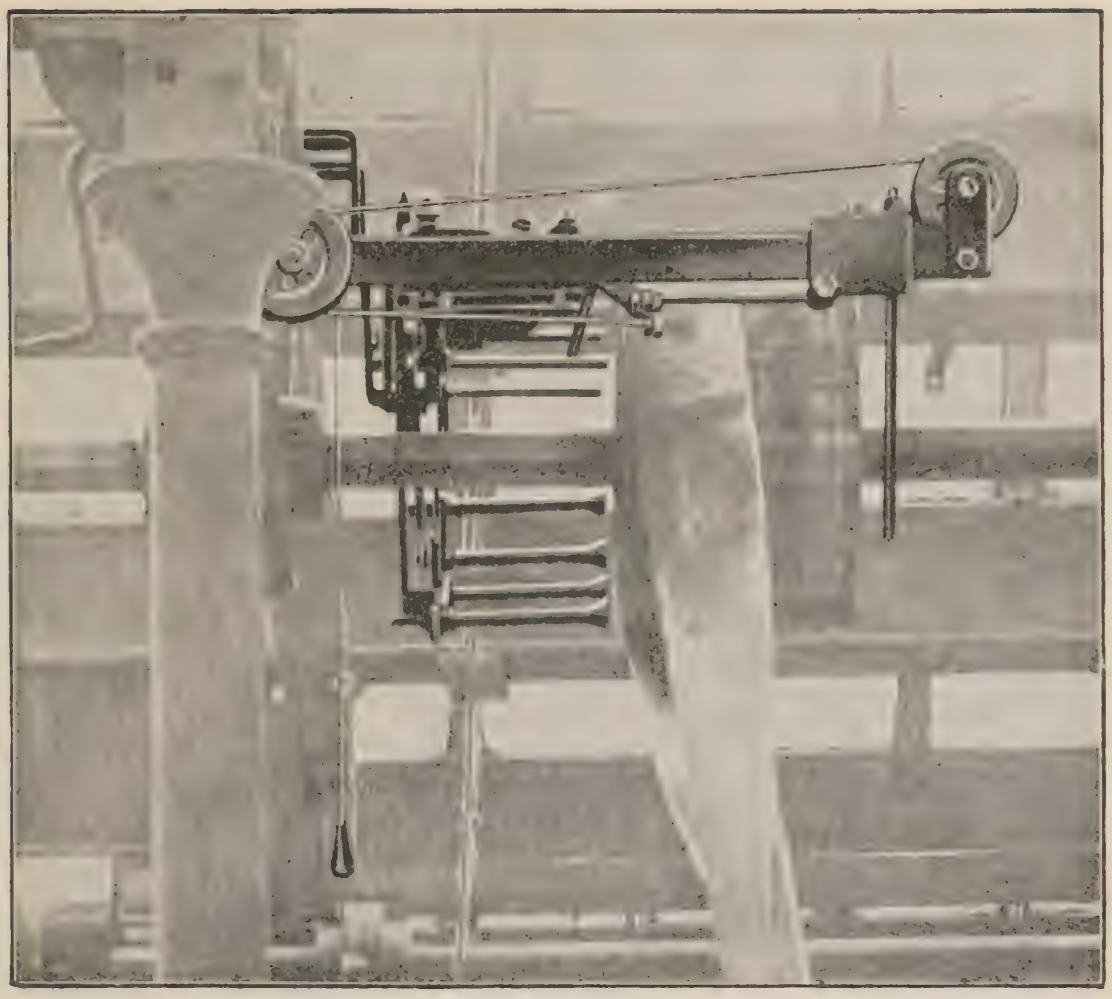


Fig. 40b.

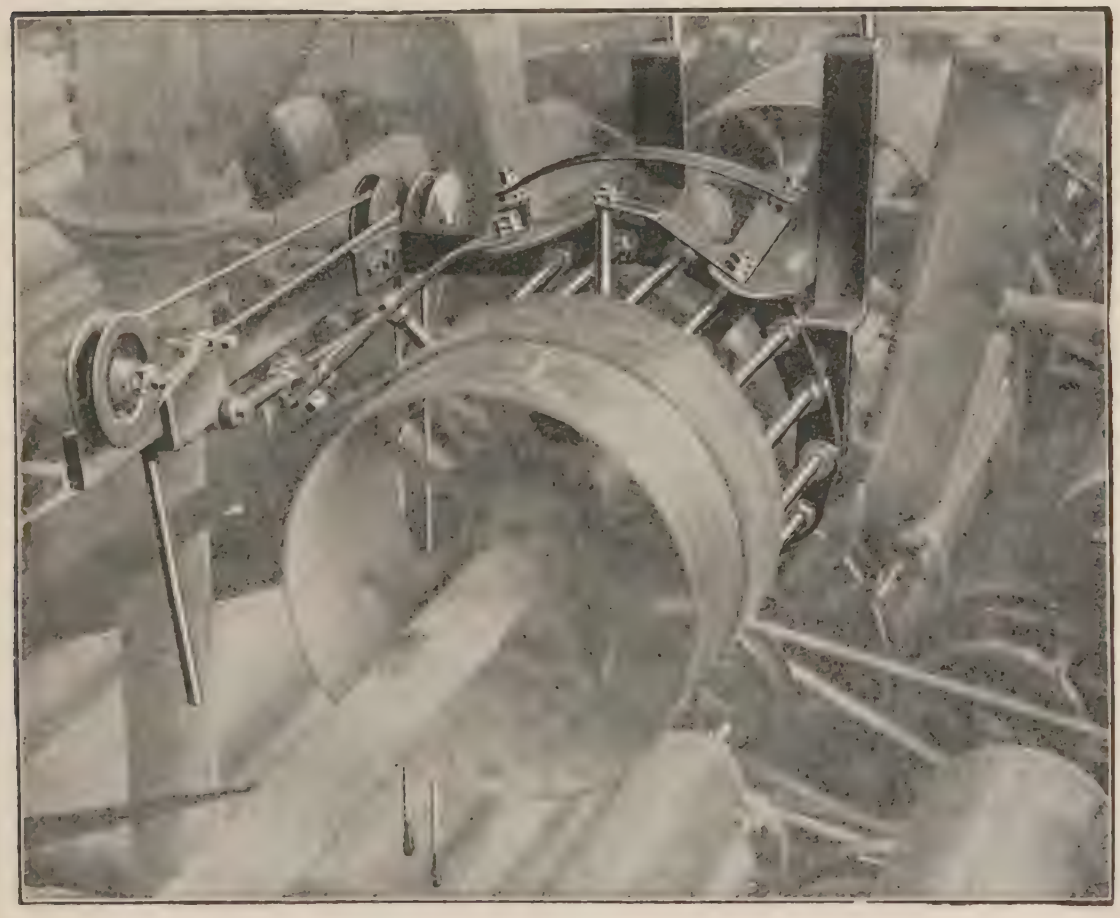


Fig. 40c.

The details of the construction include—

1. A steel frame supporting a series of pegs which may be furnished with covering tubes of brass. The first three or four pegs from the point of intake are aligned with the pulley, the others are disposed on a slightly reduced radius.

2. A system of steel links carrying the mounting fingers. The fingers may be moved simultaneously, as if the fingers of the hand were pushing the belt, or, as in the British design, the fingers may be arranged to act in turn on the belt.

3. A steel lever fixed to one of the links. The pull on the rope or chain moves this lever which, in turn, moves the links and mounting fingers.

Rotary Mechanical Mounters.—Rotary mounters vary considerably in the details of design, but, in general, they may be regarded as developments of the parent mounter of this class, known on the Continent as the Baudouin, from the name of its inventor.

The apparatus is either supported on the shaft or, as is usual, fixed independently to a strong ceiling or other support.

The following is a general description of the independently supported Baudouin mounter, illustrated in Figure 41.

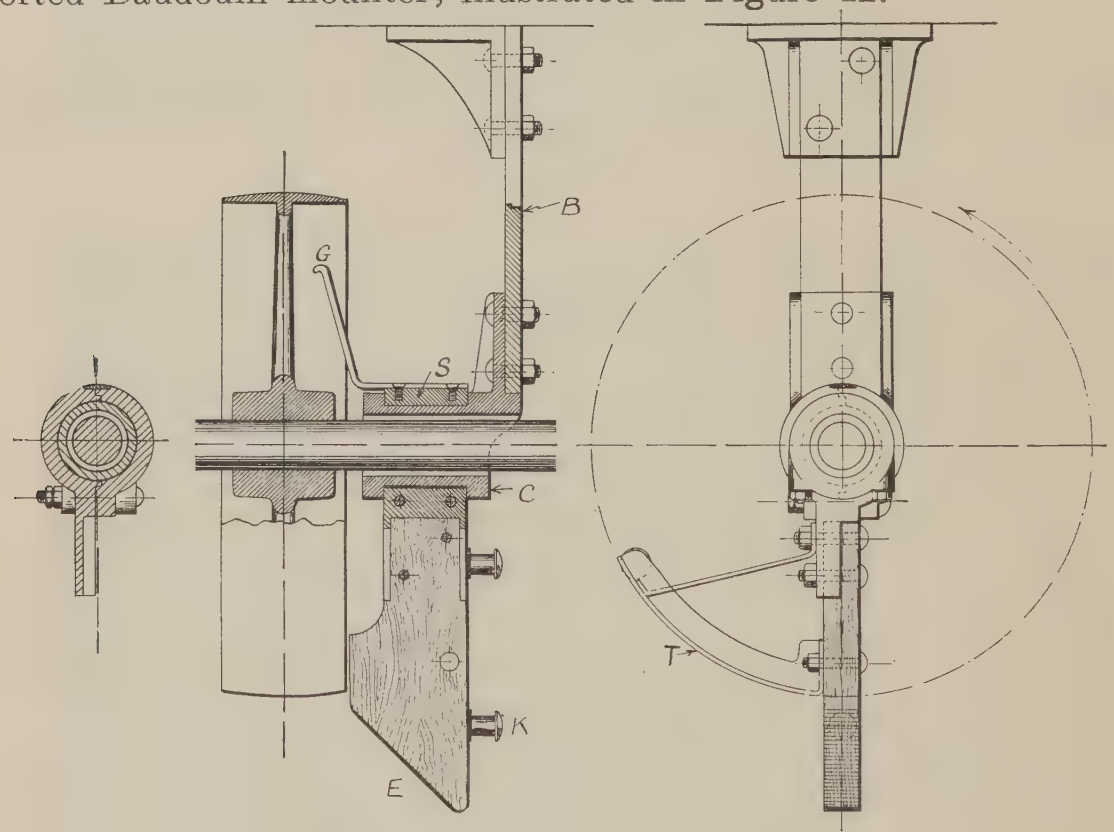


Fig. 41.—"Baudouin" Mounter.

The mounter is a flat radial arm of hard wood with a bevelled edge E directed towards the pulley rim at an angle of about 40° with the shaft. The arm is firmly fixed to the sleeve S, which acts as the perch for the dismounted belt. The sleeve rides on a collar C, which encircles the shaft, but is not in contact with it. Sleeve and collar are made in two halves for convenience in mounting. The collar is firmly secured to the ceiling or other support B, which is placed on the side of the mounter remote from the pulley. The sleeve must not ride freely upon the collar, but must be tightened

upon it so that there is sufficient friction to retain the arm in any desired position, even when the belt is supported upon it. The belt is kept from contact with the pulley arms by the guard iron G.

The rotation of the arm is effected by a pole of the type shown in Figure 42, the hook of which is caused to engage with the small knob K on the mounter arm. As the arm rotates, the bevelled

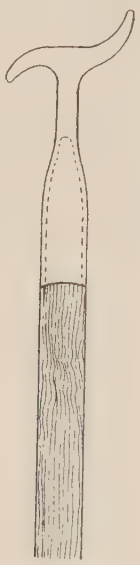


Fig. 42.

edge picks up the belt and, when the point of intake is reached, the belt begins to mount on the pulley. Further rotation of the arm completes the mounting, but in certain cases in order to assist the operation a second knob is provided at the end of a curved iron tail piece T secured to the arm. When, as a result of the initial movement, the belt has acquired a certain tension, the second knob, by a quick movement of the pole, is engaged, and the mounting completed by this means more readily than where only one knob is provided.

The iron guard wing G, fixed on the sleeve at the side adjacent to the pulley, opposite the arm, also assists to break the fall of the belt, when dismounted, accidentally or otherwise. In the case of horizontal belts, a second wing is recommended, placed at right angles to the arm, fixed on the upper part of the sleeve.

It is important that the support for the dismounted belt should be as smooth as possible, all projections being avoided, as shown.

The rotation of the arm is sometimes effected by chain and pulley apparatus permanently fixed beside the mounter (Figure 43).

A shaft-supported radial arm mounter is illustrated in Figure 44. It must not be used in locations where the shaft cannot be kept clean, because seizing of the apparatus on the shaft cannot then be avoided. Subject to this condition, the appliance may be used for mounting belts of moderate width, working tension and speed. It affords great advantage in erection by the elimination of the independent support.

The cast iron divided sleeve or boss which carries the radial mounter arm is held between collars fixed on the shaft or between the pulley boss and an outer collar. The collars are in halves,

held together and fixed by counter-sunk screws. The boss is lined with white metal and continuously lubricated from the oil cup shown, which is protected from the action of the belt by the U-shaped guard iron fixed on the boss. This iron also keeps the belt from contact with the pulley arms.

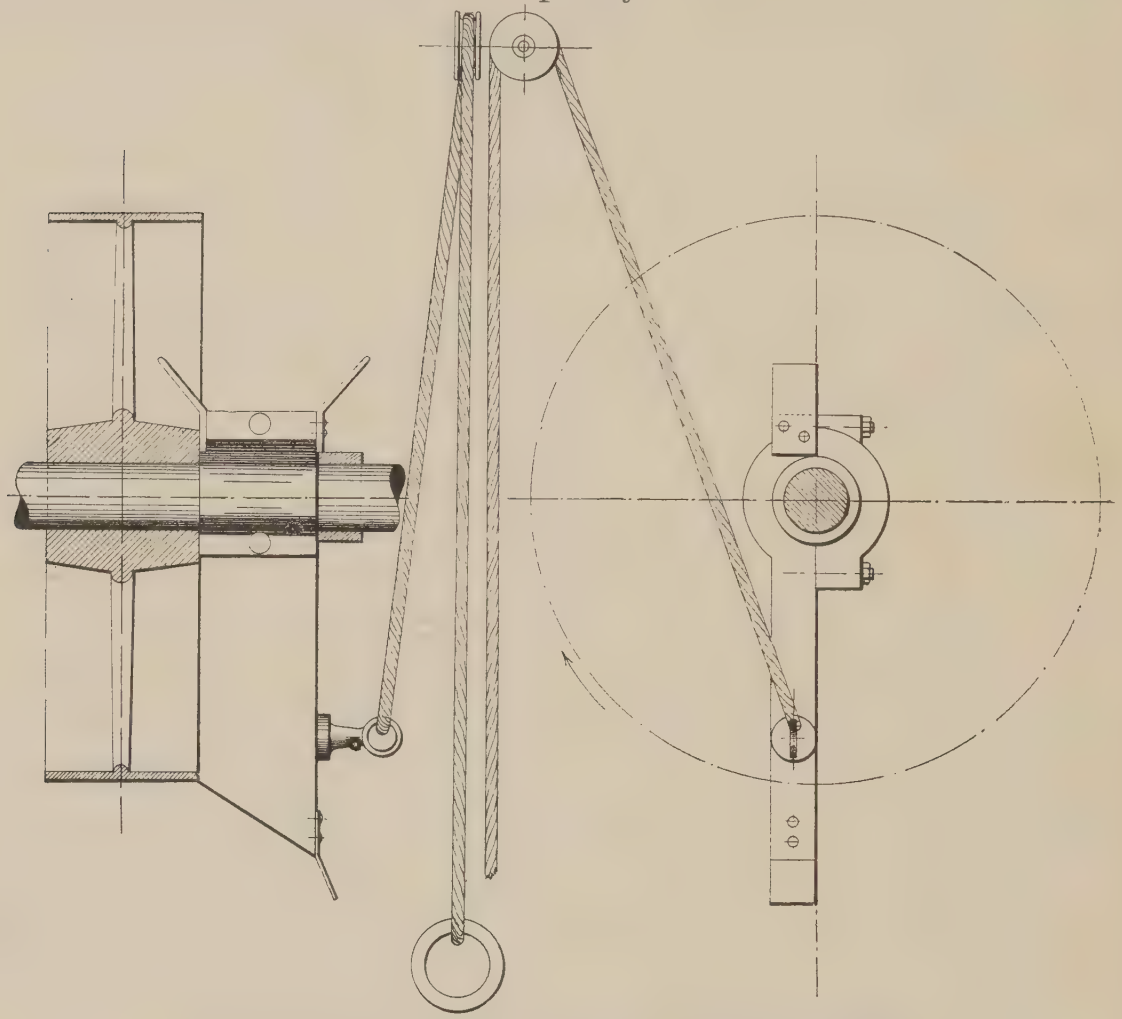


FIG. 43.—ROPE-OPERATED BAUDOUIN MOUNTER.

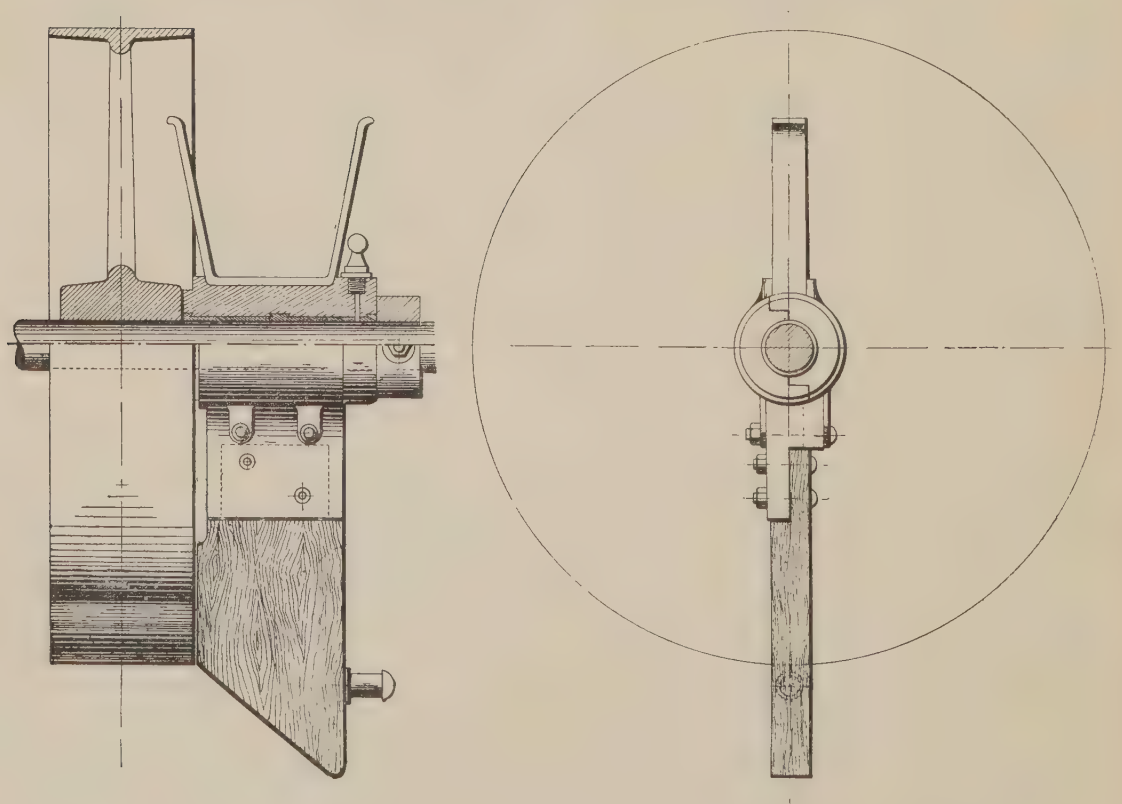


FIG. 44.—"BAUDOUIN" MOUNTER SUPPORTED ON SHAFT.

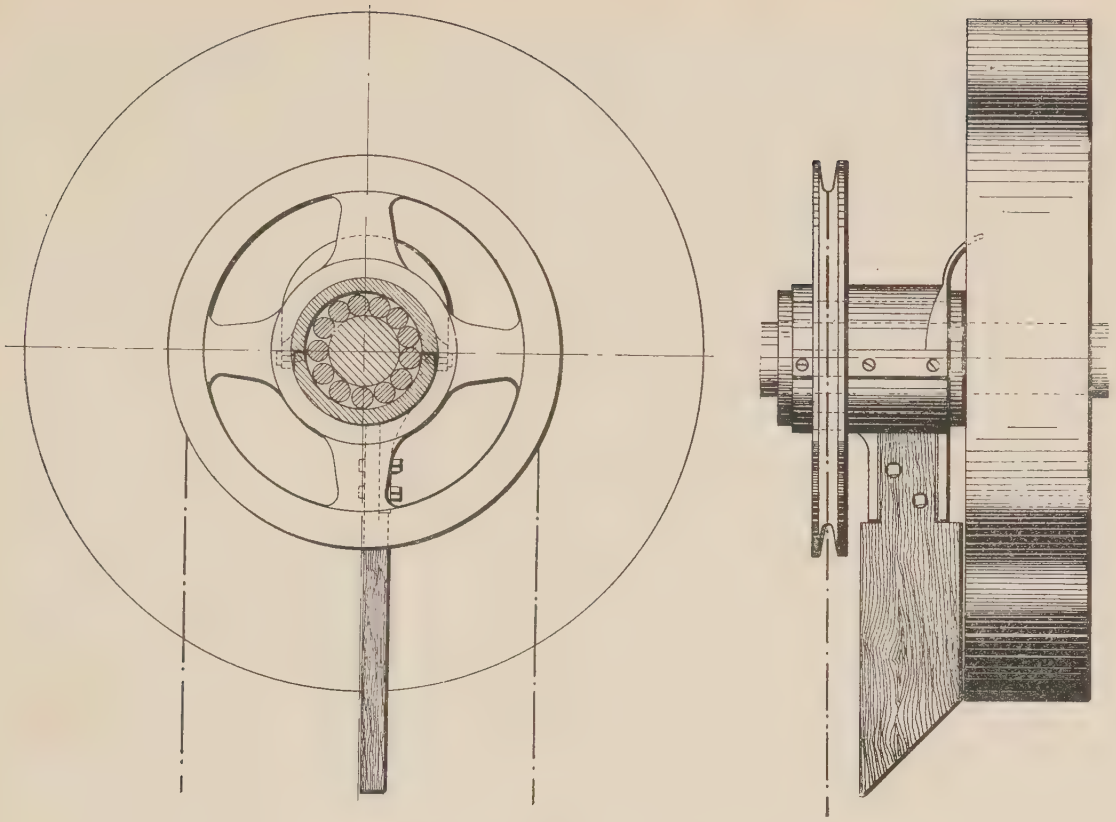


FIG. 45.—"BRANCHER" MOUNTER SUPPORTED ON SHAFT.

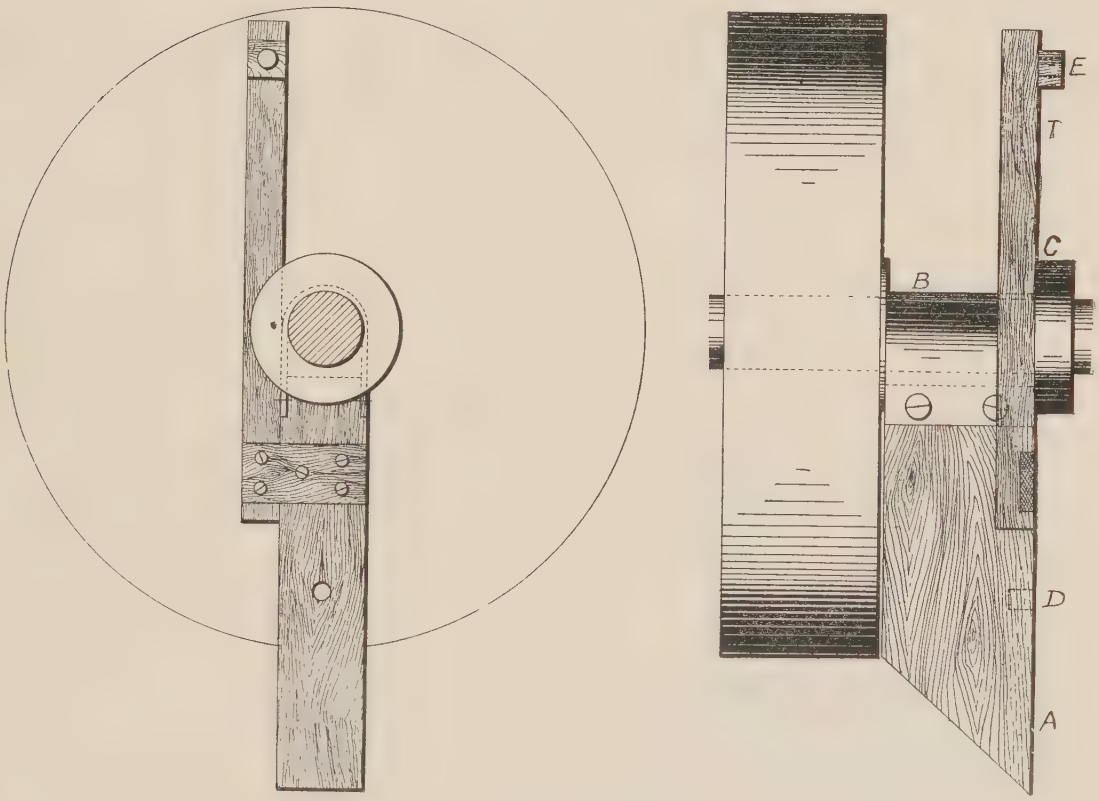


FIG. 46.—"CAPELLO" MOUNTER SUPPORTED ON SHAFT.

The boss of the "Brancher" shaft-supported mounter (Figure 45) is provided, in order to reduce friction, with hard wood rollers rotating in thick lubricant. It is not clear that this complication affords any material advantage over the construction described above.

A simple adaptation of the Baudouin shaft-supported mounter, the "Capello," is shown in Figure 46. This mounter is easily and cheaply constructed. The wooden radial mounter arm A is attached by screws to a sheet iron boss B, placed loose on the shaft, having rather more than $\frac{1}{32}$ inch clearance all round. The tail piece T, firmly attached to the arm, forms a continuation of the latter on the opposite side of the shaft. A collar C fixed on the shaft prevents lateral movement of the boss. The latter is provided with lubricating holes.

Mounting is effected with the hooked pole. In cases where the point of intake of the belt is on the lower side of the pulley, the pole is caused to engage with the blind hole D situated on the outer edge of the mounter arm. If, however, the intake is on the upper part of the pulley, the pole is engaged with the large hole in the wooden stud E, fixed on the tail piece. Contact of the pole with the shaft in the mounting operation is thus avoided. For very inclined and horizontal drives the arm must be supported out of the vertical in the angle between the two sides of the mounted belt. A suitable hooked rod attached to the ceiling or beams will suffice. Unless such provision is made, the belt, if accidentally dismounted, might strike the arm violently and so wreck the apparatus. The edge of the radial arm is continued beyond the pulley for a distance equal to about four-fifths of the width of the belt, so that, in mounting, the belt is stretched and the operation facilitated.

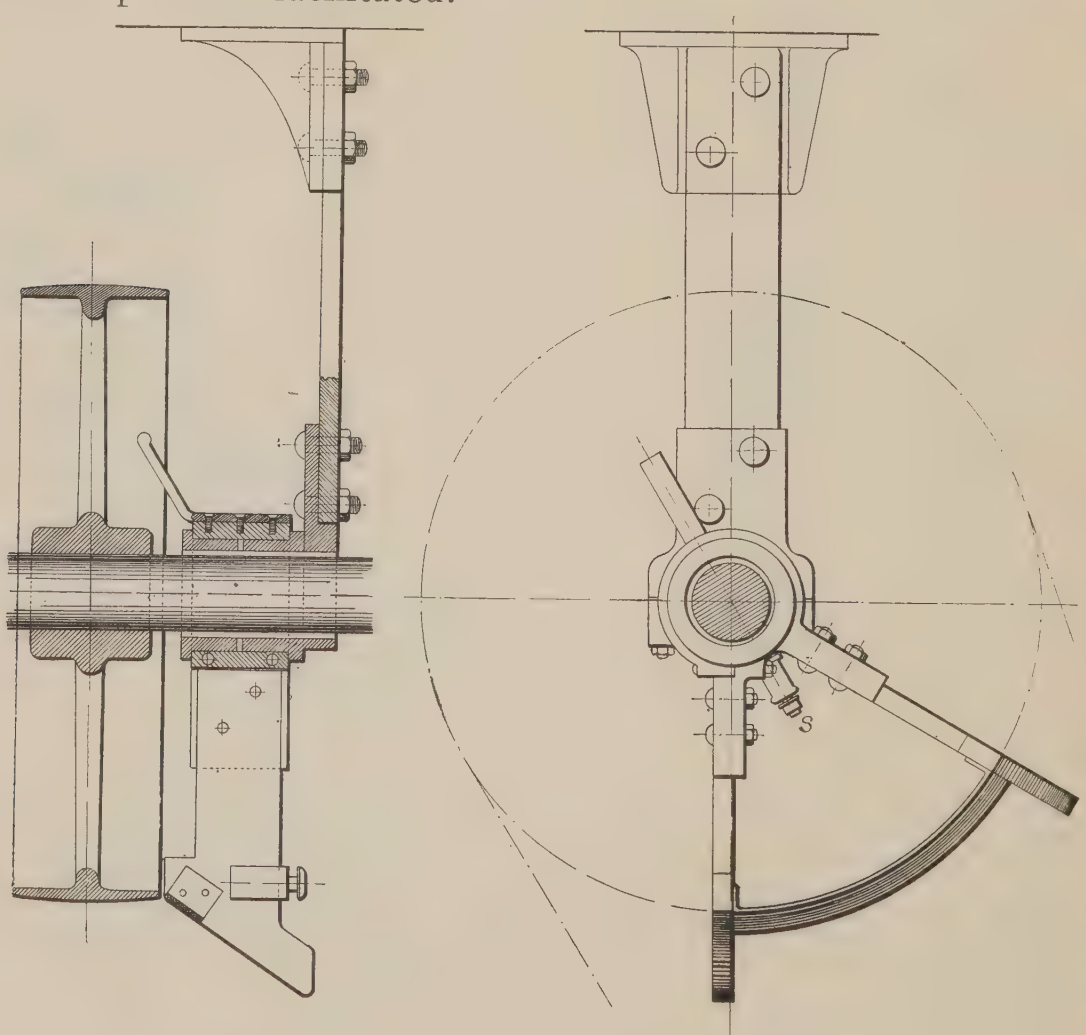


FIG. 47.—"ASSOCIATION" MOUNTER.

Many of the independently supported Baudouin mounters occupy considerable space, and, moreover, are not very adaptable for varying locations and sizes of pulleys. Much attention has been given to this matter, more especially in Italy, with a view to the design of apparatus possessing a wider range of utility. This result is largely attained in the Italian mounter, the " Association " (Figure 47), the parts of which may be standardised to a considerable extent.

The " Association " mounter is equipped with two radial arms set at an angle of from 55° to 60°, sometimes joined by a curved metal band near the inner angle of their bevelled mounting edges. The apparatus can be placed either to the right or the left of the pulley, whatever the direction of motion of the shaft. All that is required for fixing is a free space near the side of the pulley, from 2 to $2\frac{1}{2}$ inches wider than that of the belt. The constituent metal parts are reduced to the minimum consistent with adequate strength, so as to secure lightness and simplicity. All projections are scrupulously avoided.

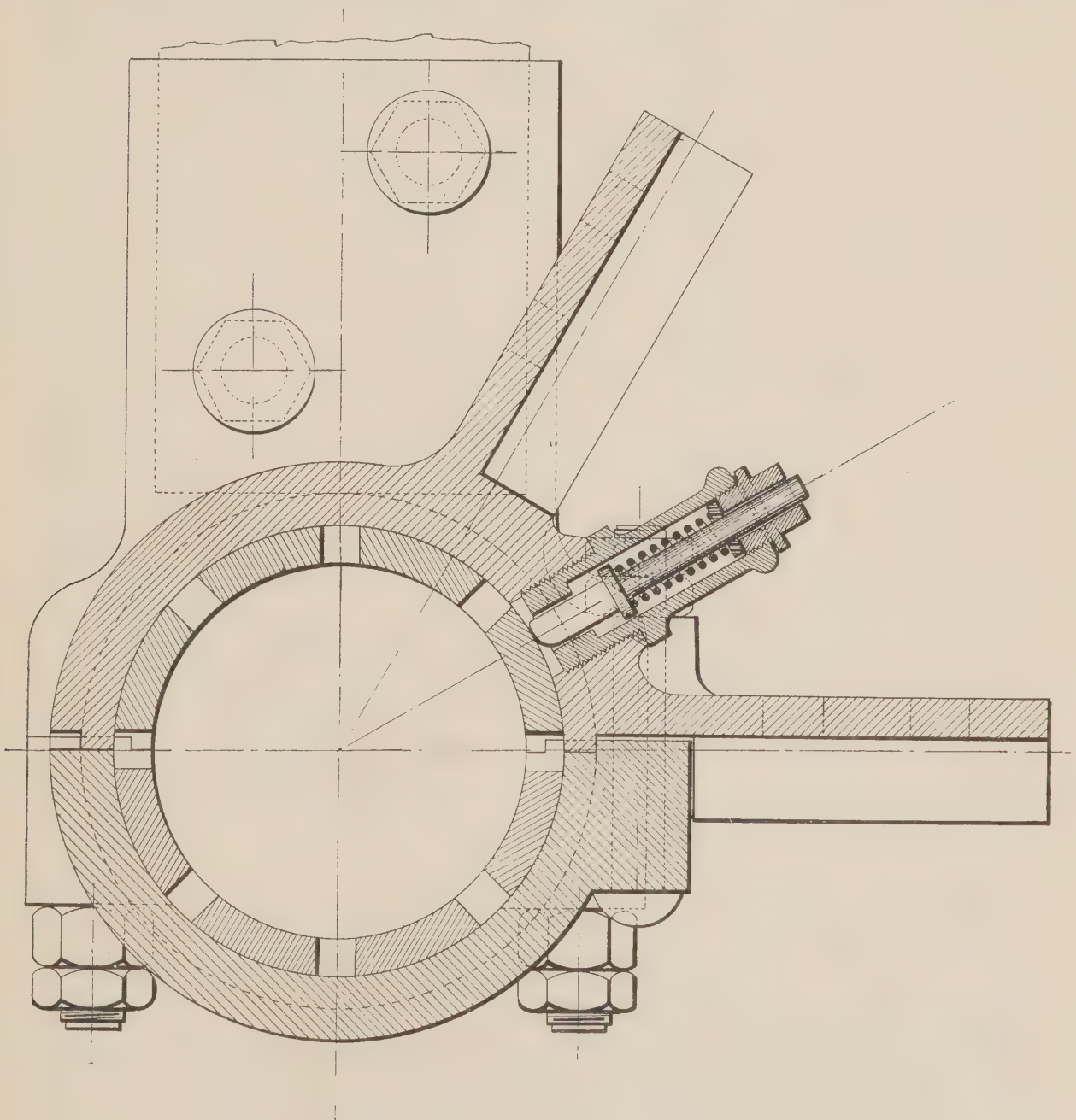


FIG. 48.—ENLARGED SECTION OF SAFETY CATCH "S" (Fig. 47).

The sleeve of the mounter is fitted with a spring safety catch, S (shown enlarged in Figure 48), by means of which the mounter is prevented from moving back and the use of the pole made easier. Also, when the belt is mounted, the radial arms can be placed and held between the two sides of the belt (Figure 47); then, should the belt be accidentally dismounted, there will be no danger that it may catch in the mounter. The safety catch is therefore almost indispensable.

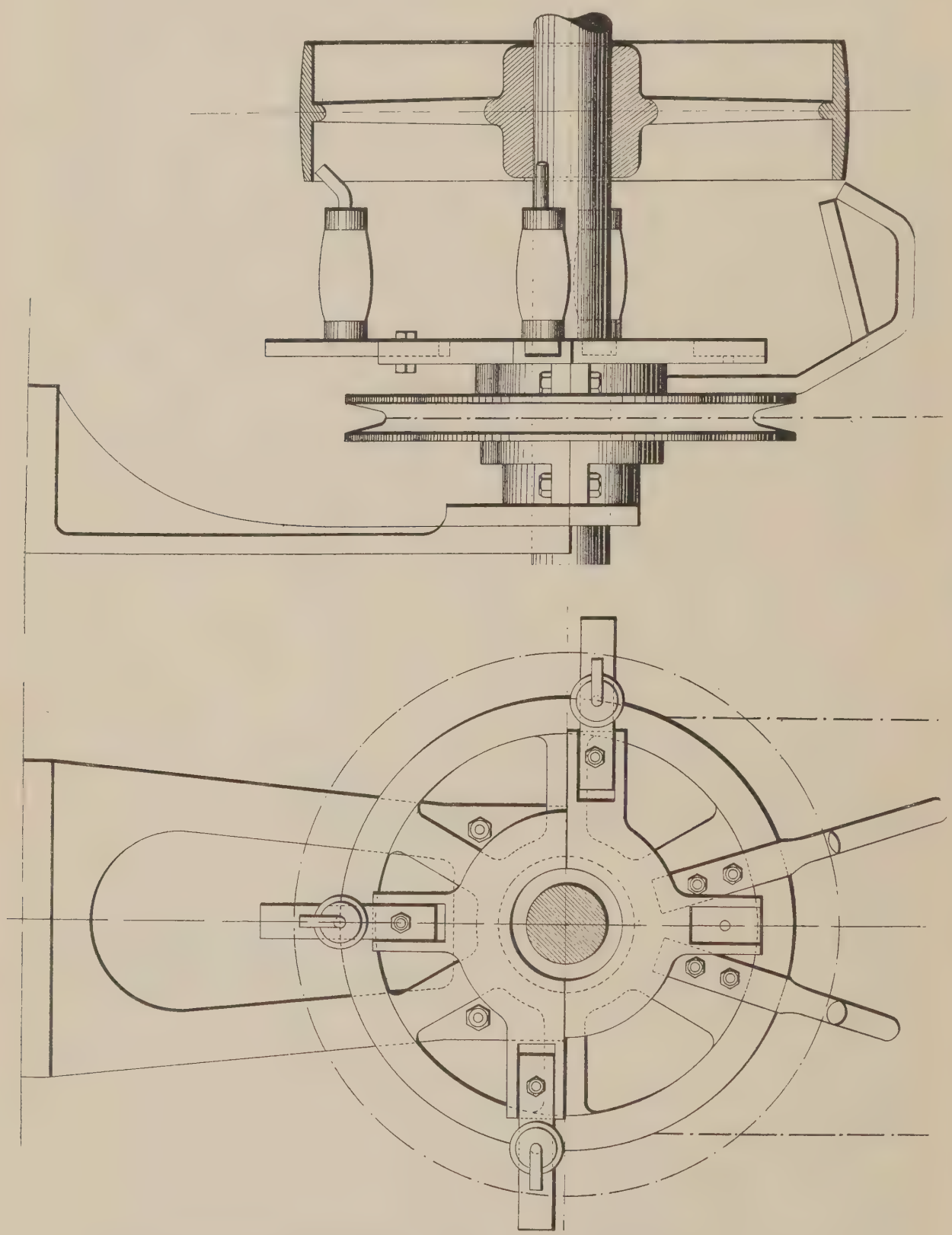


Fig. 49.—"Cowley" Mounter.
(Messrs. H. W. Cowley & Co., Ltd., Bella Street Ironworks, Bolton.)

By standardising details, the only parts which may require to be adapted to the specific conditions of installation are the adjustable iron supporting arm and the wooden mounter prong.

The curved iron connecting the bevelled edges of the radial arms, if properly made, is a valuable adjunct because of the guidance it gives to the belt. It is not, however, essential and unless properly shaped is best omitted. Some amount of skill is required in making it; it must follow exactly the line of the pulley rim at a distance of not more than $\frac{1}{8}$ inch.

Rotary mounters installed for mounting heavy belts on large pulleys must necessarily be of very substantial construction. The perch, in particular, must be strongly made and supported so that it will be capable of withstanding the shock of impact of the belt, when the latter is dismounted at full speed. Strong perches of the " peg " type have been introduced with success in types designed and used in this country, the perch consisting of

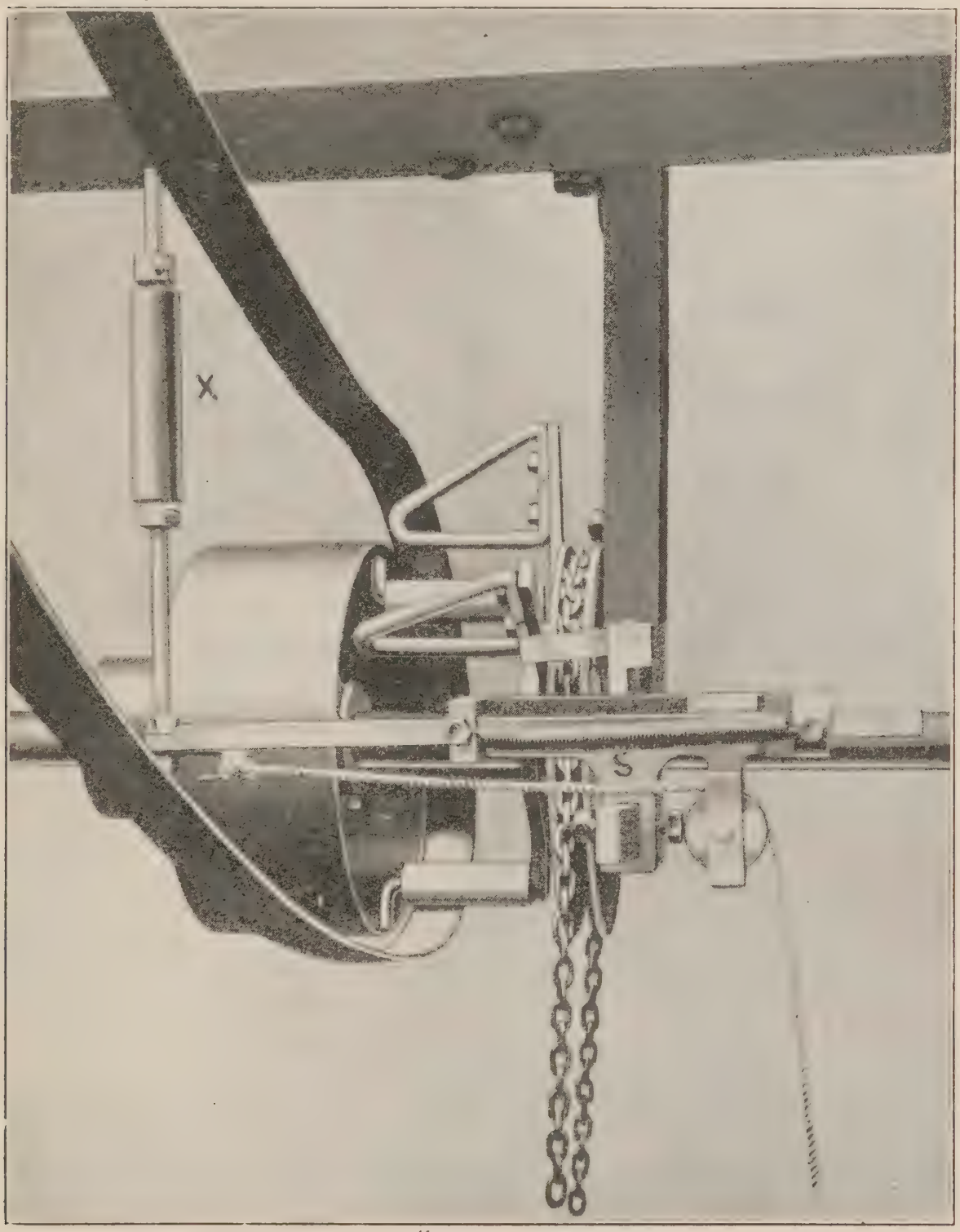


Fig. 50.—"Saxon" Mounter.
(Messrs. Geo. Saxon, Ltd., Openshaw, Manchester.)
(Exhibited at the Home Office Industrial Museum).

three or more large size hard wood rollers, fixed on the mounter sleeve (Figures 49 and 50). This arrangement is of advantage in the mounting operation, the dismounted belt being spread out on the pegs is the more readily moved by the radial mounter arms.

In these designs, the method introduced for securing the rotation of the mounter arms avoids the use of a pole. The arms, of round iron, are fixed on a free wheel carried on the sleeve, the wheel being rotated by a hanging endless chain. Provision is made for a measure of adjustment to suit different sizes of pulleys and varying locations.

A type of rotary mounter, which differs in construction and operation from those previously described, is illustrated in Figure 51. It is known as the " Helicoidal " mounter, and was designed

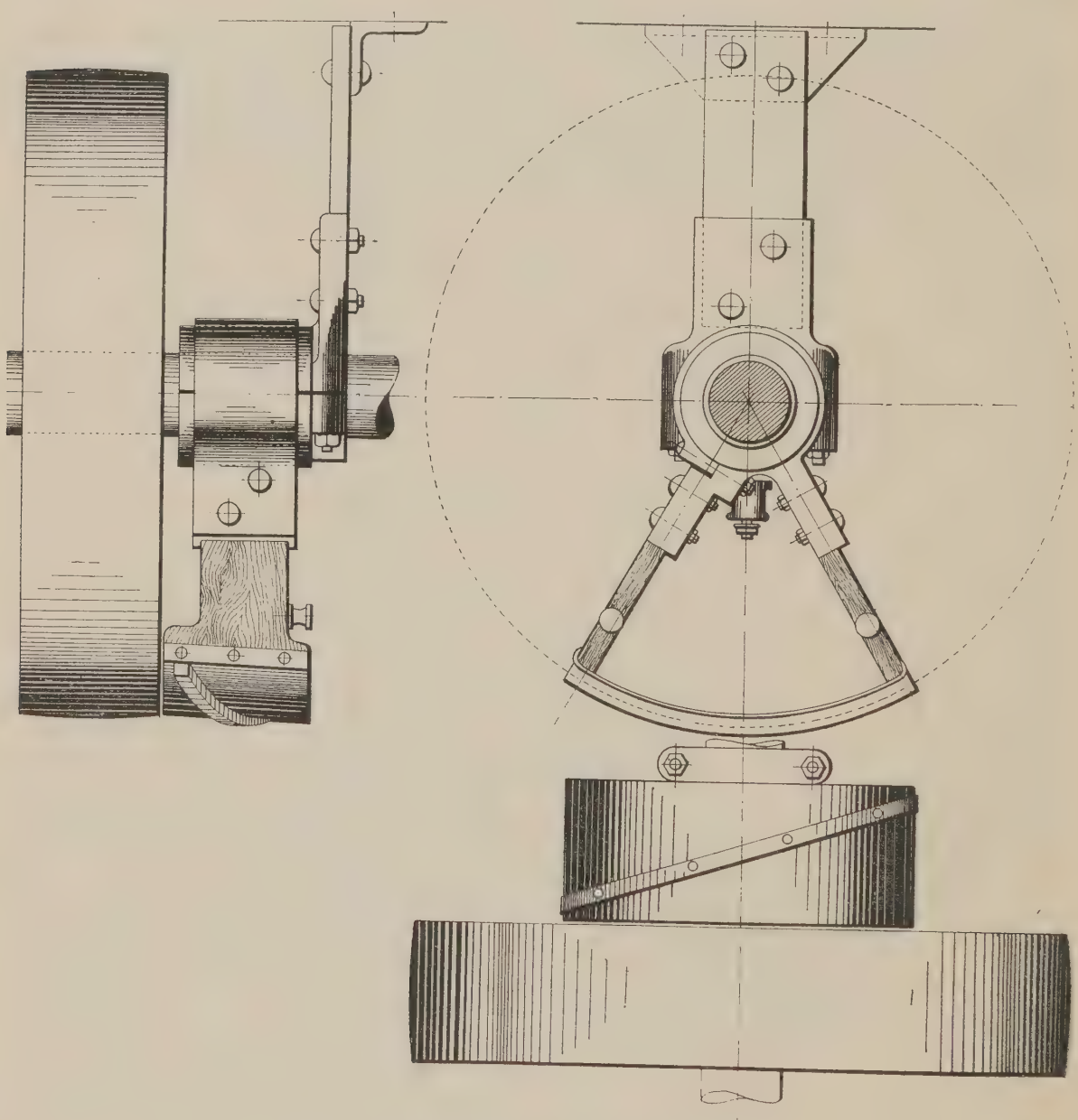


Fig. 51.—" Helicoidal " Mounter.

specially for pulleys in positions close to ceilings and other obstacles, where the usual type of projecting radial mounter arm cannot be used. Two arms are used as in the " Association " and certain other types, but the inclination of their mounting edges is

very slight, varying from 5° to 10°. The arms are joined by a wide metal band similarly inclined, on which is securely fixed a strong bar of iron following a helical outline relatively to the shaft. The rotation of the mounter, effected by a pole or otherwise, causes this helical projection to push the belt into position.

The rotary mounter, Figure 50, is fitted with a dismounting device X. This is a useful but not essential detail. It consists simply of a stout peg placed approximately at right angles to the belt near the point of intake, on the side of the pulley opposite the mounter. It is operated independently by the pull of a cord which moves the end of the rod from which the peg is suspended. The rod and peg are restored to the correct position after use by the action of the spring, S.

The following precautions, where applicable, must be observed in connection with the installation and use of rotary and other mechanical belt mounters :—

(1) Supports must be suitably designed to resist the forces called into play by the mounting and dismounting operations, and be firmly secured. The design of the supports must have regard to the position of the belt in relation to that possible for the supports. Light, ill-designed gear is liable to be wrecked under certain circumstances. It is most important that there be no tendency to deformity of the apparatus (see 4).

(2) The fixed collar for rotary mounters must be truly concentric with the shaft. The sleeve, although free on the collar, should be sufficiently tightened upon it (see p. 42). The part on which the dismounted belt rests should be free of projections and as smooth as possible.

(3) Rotary arms must be radial. The bevelled mounting edge should be inclined at about 40 degrees to the shaft. For single arm mounters the mounting (inner) edge should be about 1 to $1\frac{1}{4}$ inch beyond the pulley edge. For double arm mounters, the edge should be practically coincident with the pulley.

(4) It must be impossible for the belt to be forced accidentally between the pulley and the mounter. The clearance should not be more than $\frac{1}{8}$ inch or thereabouts.

(5) Mounters with two arms should be provided for wide belts working under considerable tension. They afford advantages over single arm mounters in that the belt is not twisted to the same extent, is subjected to less damage, and is more readily mounted.

(6) In dismounting, the rotary mounter must be in such a position that the falling belt is projected on the sleeve or other perch and not on the mounter.

(7) Adequate lubrication of the sleeve of the shaft-supported rotary type must be assured.

Dead Pulley Mounting Gear on Driving Shafts.—A loose pulley, commonly known as a dead pulley, is sometimes used as a mounting appliance, for which purpose it is very effective. Two arrangements are depicted in Figures 52 and 53. The loose

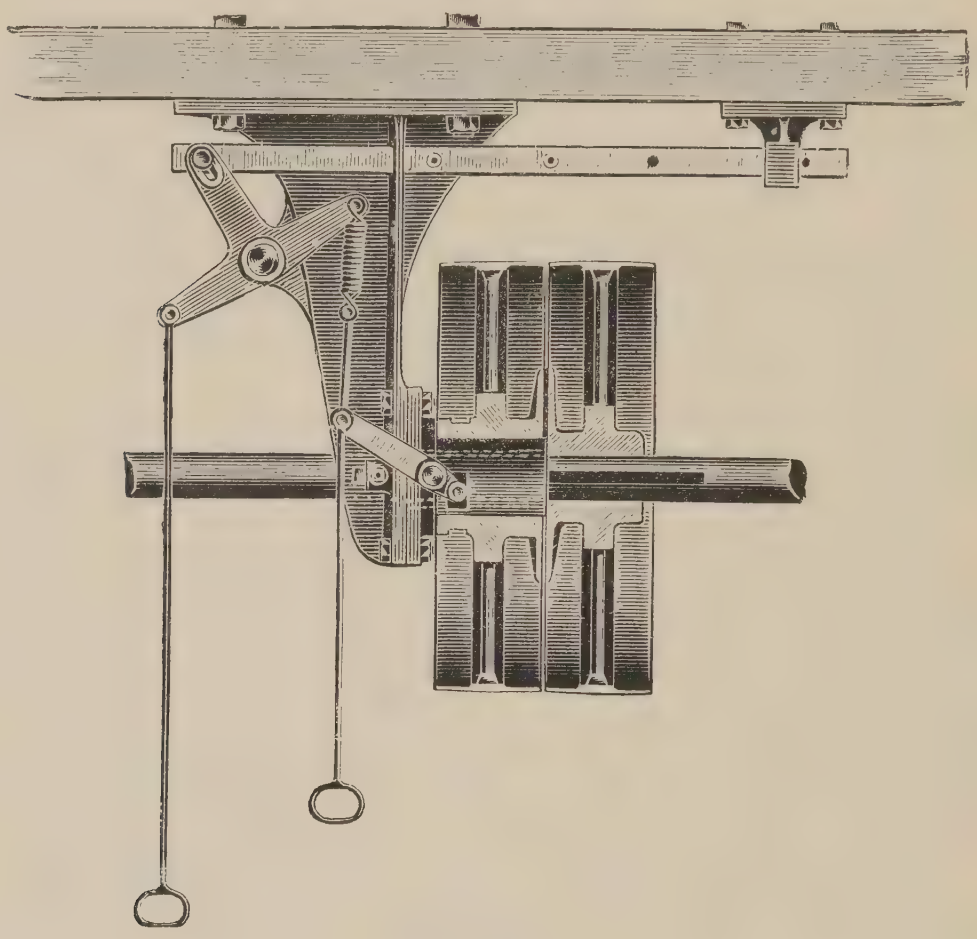


Fig. 52.

or dead pulley P (Figure 53), placed beside the driving pulley, is mounted, not on the shaft, but on an adjustable cast-iron sleeve carried by a hanger, the sleeve being clear of the shaft. Consequently, when the belt is moved on to the loose pulley, it comes to rest. Dead pulley gear is to be distinguished from ordinary fast and loose pulley gear, as installed on driven shafts. With such gear the belt remains in motion whether riding on the fast or on the loose pulley.

The design of the gear in Figure 52 includes means for moving the dead belt from the loose to the fast pulley. The loose pulley can be moved along its sleeve support a small distance, this lateral movement being effected from a floor position by the lever operated by the hanging rod. This movement establishes frictional contact between the two pulleys, and the loose pulley is set into motion. The belt may then be moved to the fast pulley by means of the ordinary belt fork arrangement provided.

The device for moving the dead pulley laterally on its sleeve is omitted in Figure 53. The belt in this case is moved on to the fast pulley by the simple expedient of edging it sideways with the fork at the same time that it is being pulled round by hand, this

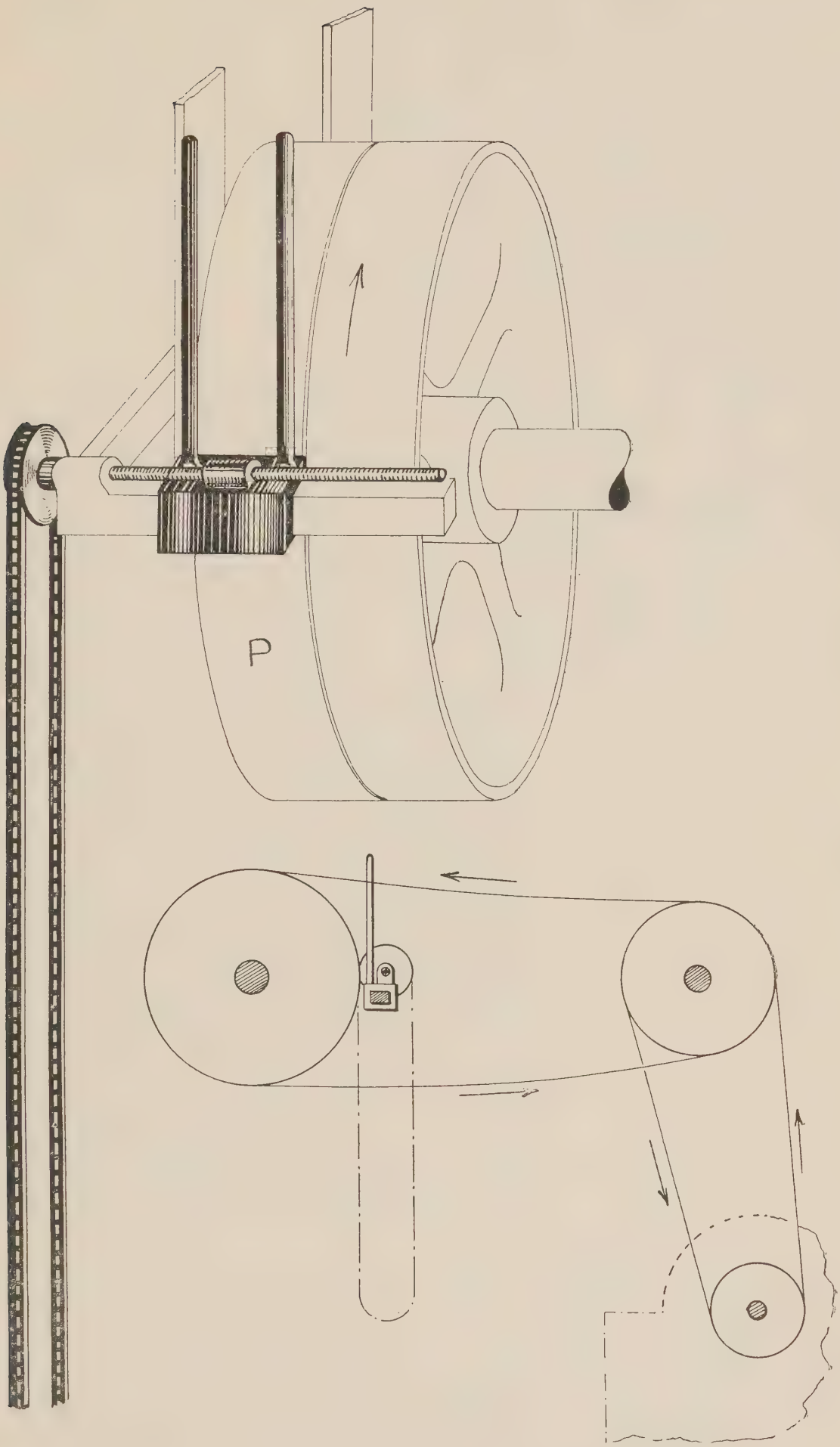


Fig. 53.—Dead Pulley Gear

being accomplished from floor level by pulling on the machine belts. As the belt begins to " lick " the fast pulley it comes gently into motion when the full use of the belt fork will complete the mounting.

Dead pulley gear has not, unfortunately, a wide field at present, nor has it been extensively adopted. It is chiefly used for disconnecting, temporarily, parts of the driven machinery which may have to stand for a long time while the rest is working, e.g., blowing and scutching machinery in cotton mills. The use of the gear ensures complete stoppage without it being necessary to dismount the belt, and affords ready means for safely replacing it on the driving pulley.

IV.—SPECIAL BELT MOUNTING PROBLEMS.

Reversing Arrangements for Belt-driven Carding Machines.—A special belt mounting problem is met with in connection with the working of carding machines in the Textile Industry. The card wire (" teeth ") on the surface of the cylinder has to be ground from time to time, and for this purpose it is necessary to reverse the direction of motion of the cylinder. The usual method of accomplishing this is to remove the ordinary driving belt and substitute a special belt, open if the driving belt is crossed and vice versa. When grinding is completed, the belt has to be changed again. The changing of carding belts is therefore a common occurrence. It is effected with the shaft running at ordinary speed, and involves grave risk to the operator if he approaches the driving shaft to mount the belt on the driving pulley—a frequent practice, particularly in woollen mills, where the heavier driving belts are used. So long as the work is done with the shaft running in this way, safety can only be assured by the use of efficient belt mounting appliances. The problem, however, may be satisfactorily dealt with in another manner, viz., by the provision of appliances which enable the reversed drive to be effected without changing the belt. Several devices of this kind are available, and are successfully used. Examples are illustrated in Figures 54, 55 and 56.

In all these cases a modified driving gear is substituted for the ordinary fast and loose pulley. In the Dawson and Glennon devices, the pulley fitted beside the loose pulley on the cylinder shaft is used, in ordinary working, as a fast pulley, special locking arrangements being provided. For grinding, it is unlocked. This pulley has an independent groove for driving a second belt (Dawson), or a rope (Glennon)—these being put on with the machine stopped. The belt or rope (open or crossed according to circumstances) drives a pulley on the adjoining swift shaft. The motion is transmitted back to the cylinder shaft by a belt at the other side of the machine. The Wigglesworth device depends for its reversing action on gear mechanism within a specially designed pulley.

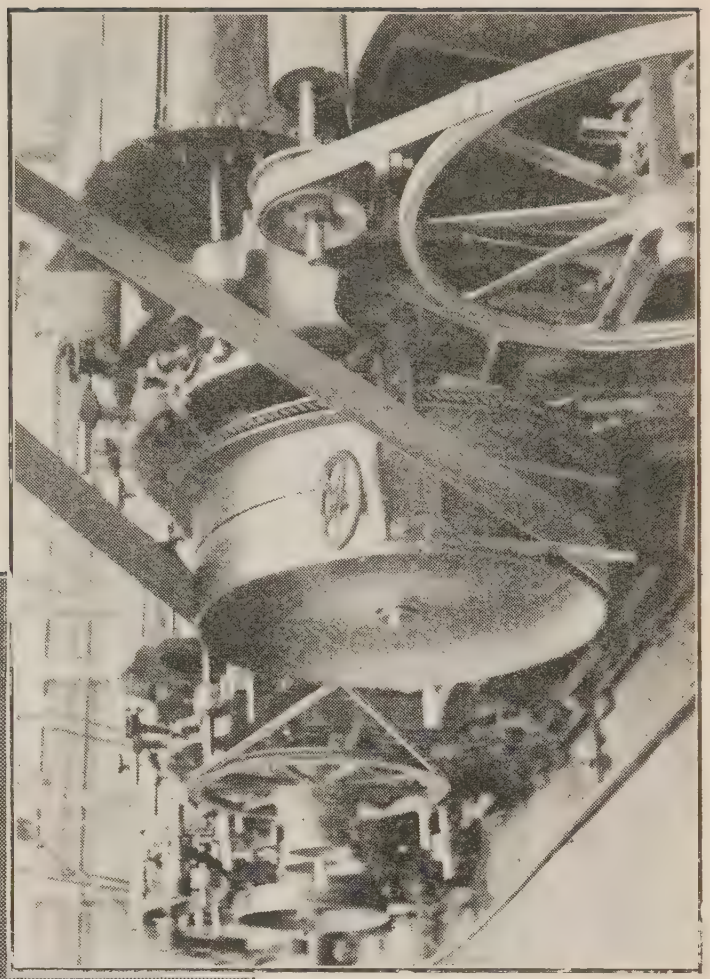


Fig. 55.—("Glennon.")

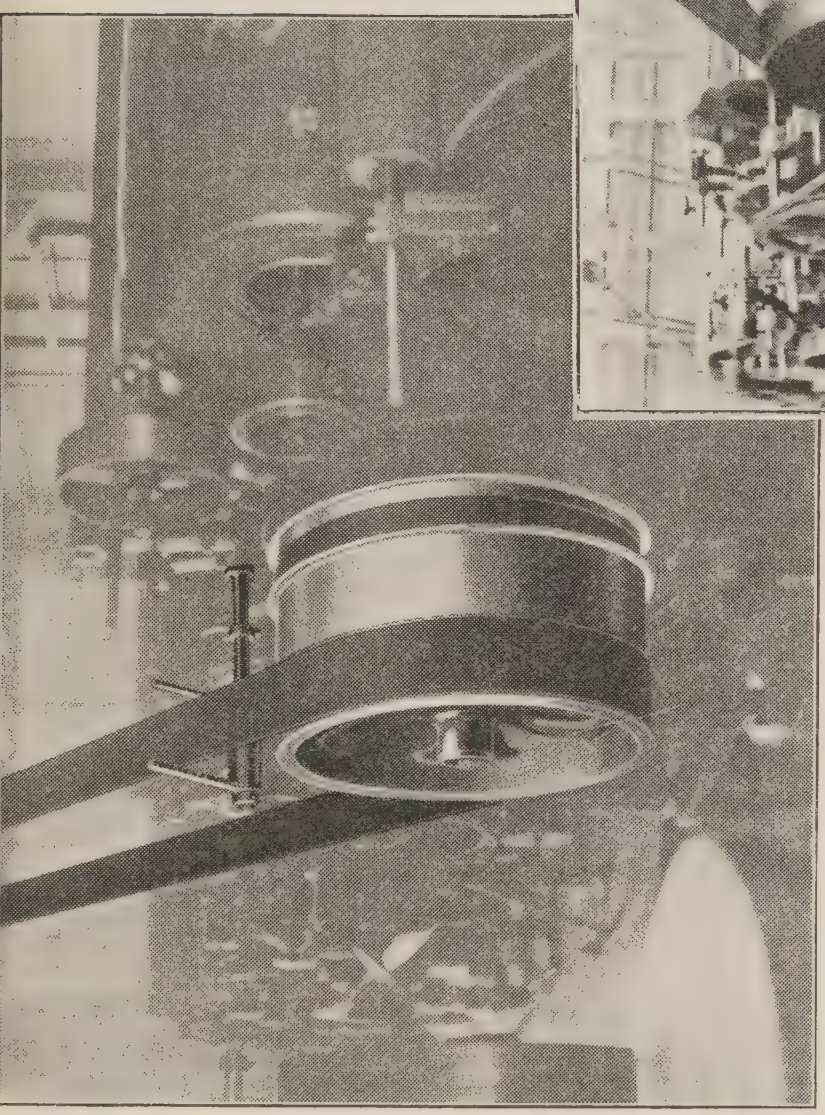


Fig 54.—("Dawson.")

(Messrs. Crofts (Engineers), Ltd., Bradford.)

Mechanical Belt Shifters for Stepped Cone Pulleys.—The movement of belts by hand on stepped cone pulleys of lathes and other machines gives rise to a definite accident risk which, while by no means as serious as that associated with the mounting of belts on driving pulleys on line shafting, is nevertheless serious enough to demand appropriate precautions being taken to guard against it.

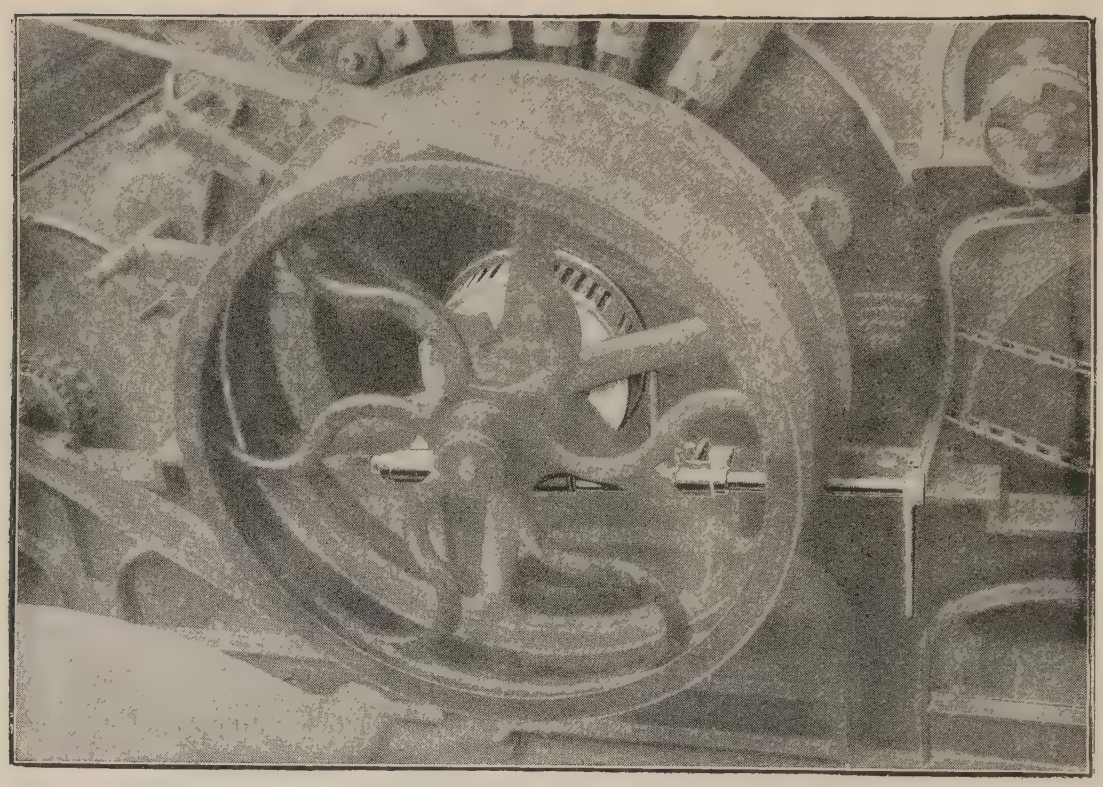


Fig. 56.

(Messrs. Frank Wigglesworth & Co., Ltd., Shipley.)

The possibility of a serious accident being caused will arise if the worker approaches the rotating countershaft for the purpose of adjusting the belt on the driver cone. He should, therefore, under no circumstances whatever, be allowed to do this. The operation should be effected from floor level, either by means of a suitable hooked pole or belt stick, or where this is inconvenient, the machine should be fitted with a mechanical belt shifter device.

A number of speed cone belt shifters are available, of somewhat similar construction, though differing in detail. In the Bamag apparatus (Figure 57) the speed cone driving belt passes through an " eye " of special construction placed overhead on the intake side of the belt close to the driver. The " eye " is supported on a short radial " arm " which is carried on a long operating rod, more or less vertical. This rod, which is suitably supported, may be rotated, a handle being fixed upon it at a convenient height to enable the movement to be effected by the worker from a standing position at the machine.

The complete swing of the radial arm must be sufficient to move the belt over the entire range of " steps " of the cone. In order that it may adapt itself to the different diameters of the steps, the eye must (i) receive a turning movement additional to that imparted to the radial arm, and (ii) move inwards towards or outwards away from the rod. An enlarged view of the eye and its support is shown in Figure 58. The eye is rectangular in form

Fig. 57.

(Messrs. Bamag-Meguin (Gt. Britain) Ltd.,
Broadway Bldgs., Broadway, London, S.W.1.)

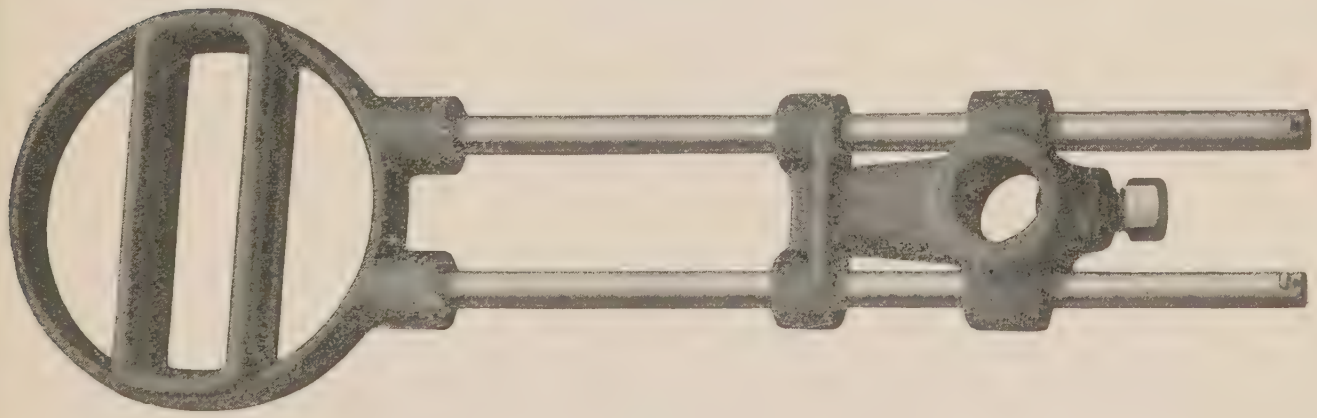


Fig. 58.

(Exhibited at the Home Office Industrial Museum.)

free to move in a circular collar. The collar is supported on two long pins, which can slide in guides cast on the bracket mounted on the operating rod.

The action of a speed cone belt shifter, provided with a single eye or fork near the driver cone, may be insufficient to ensure the necessary movement of the belt along the steps of the lower or driven cone. The final adjustment of the belt to the required step of the driven cone has then still to be made. Unless the machine is

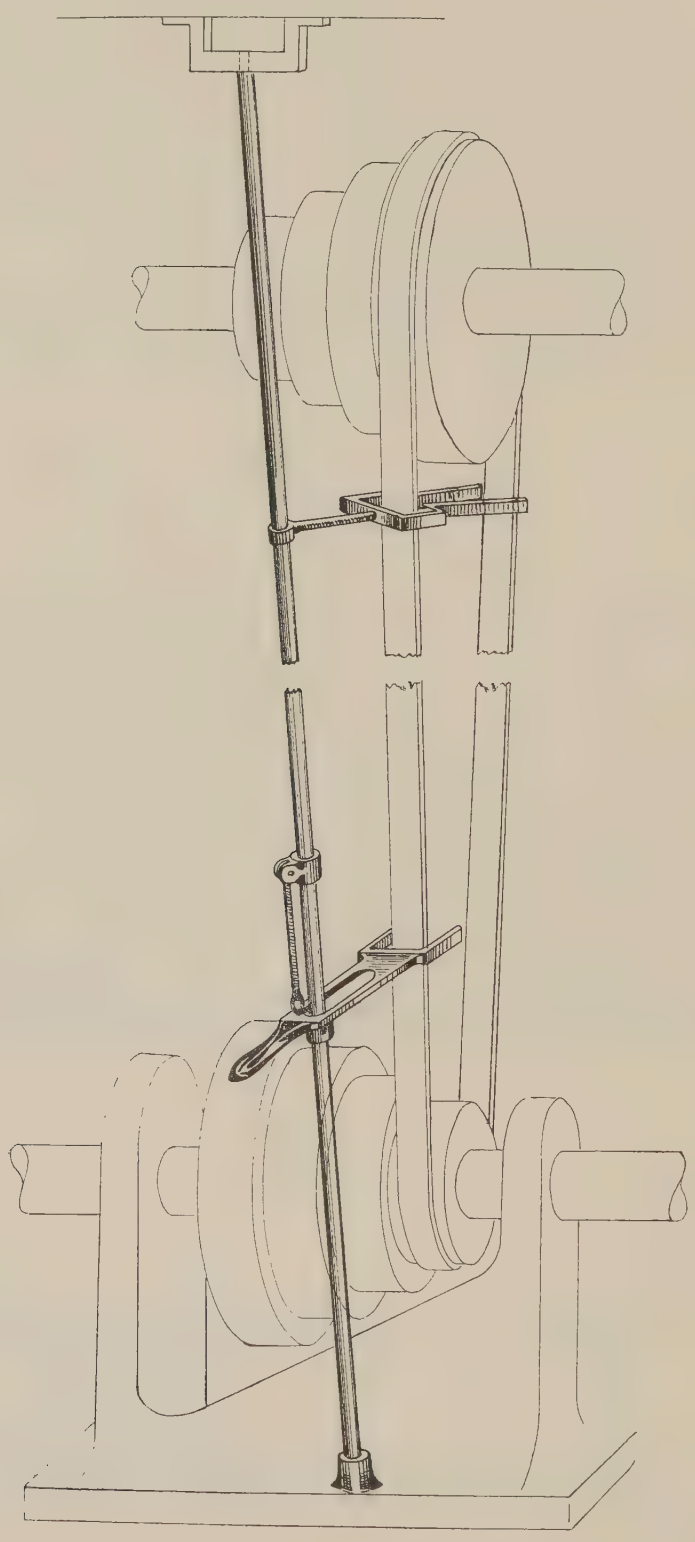


Fig. 59.—Speed Cone Belt Shifter with two Forks.

stopped, this adjustment, if effected by hand, may give rise to accident at the driven cone. Speed cone shifters, provided with two eyes or forks, one near each cone, have been introduced which effect the necessary full movement of the belt when the handle is moved. A shifter of this type is illustrated in Figure 59.

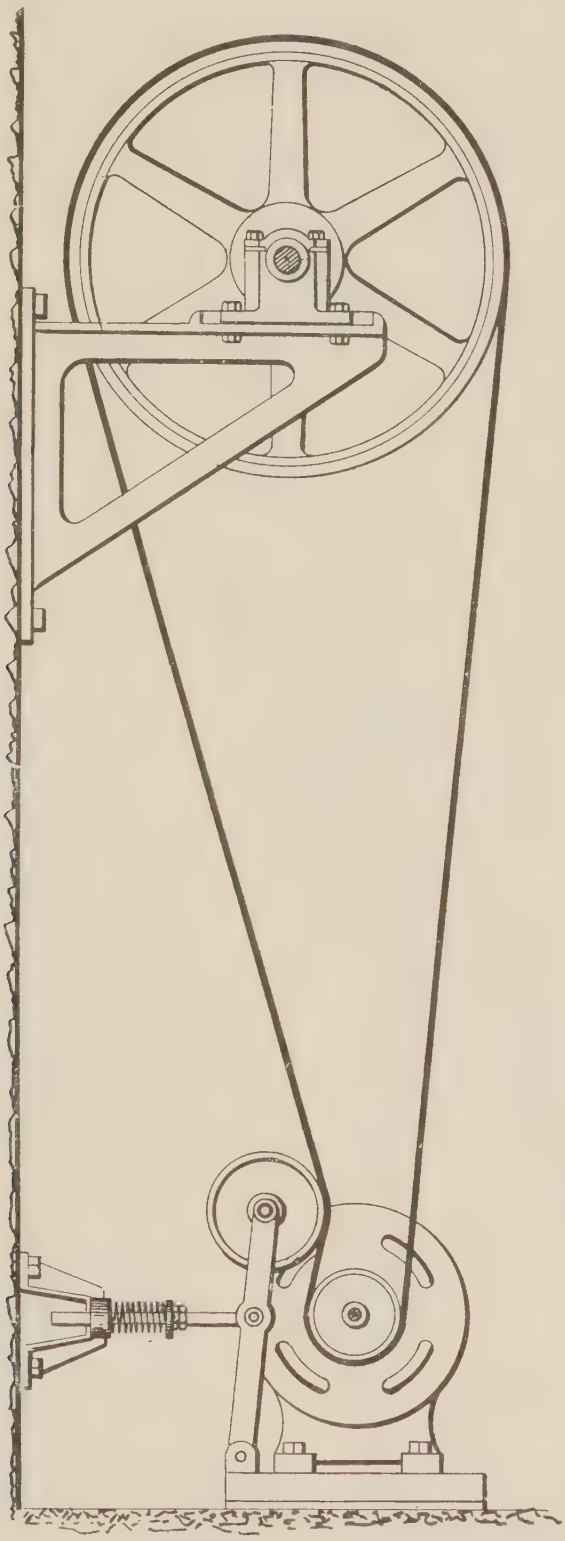


Fig. 60.—Belt-tightening Gear.

V.—INSTALLATION, MAINTENANCE AND INSPECTION OF BELTS.

Belt mounting necessitated by belts breaking or slipping off the pulley may be avoided to a considerable extent by suitable precautions. The risk of breakage increases as the belt deteriorates

through use, so that care and maintenance, coupled with routine inspection, are of great importance as safeguards. In many factories this is a well-recognised fact, with the result that an almost complete immunity from belt breakage during work is secured.

Excessive initial tension in belts, sometimes a cause of breakage, may be avoided by the use of a device for adjusting the tension (Figure 60).

Another common cause of breakage arises from careless or ignorant attachment of belt fasteners, and more particularly metal fasteners. Mistakes to be guarded against include :—

(1) Fixing metallic fasteners in wrong position, e.g., crosswise instead of longitudinally.

(2) Cutting the butt ends of the belt otherwise than at right angles to the line of the belt, so producing uneven strain in use.

(3) Using fasteners too small or too light.

(4) Making the holes for the fasteners unnecessarily big and so weakening the cross section of the belt.

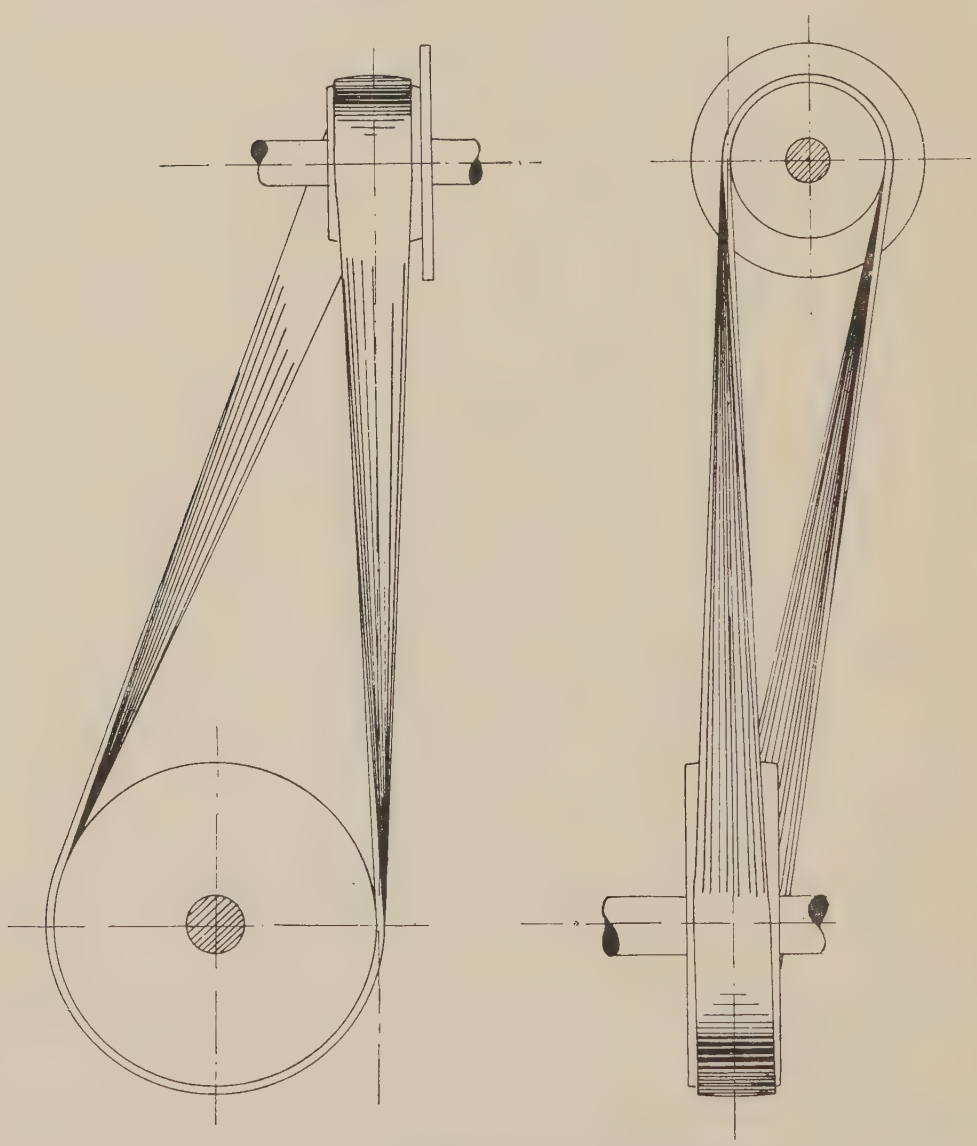


Fig. 61.—Quarter Twist Drive.

The accidental dismounting of belts which are allowed to become too slack may also be overcome by proper supervision.

Other causes of dismounting which should be avoided include undue narrowness of belts and small sizes, widely different diameters and inaccurate alignment of pulleys. Accurate installation of the pulleys is particularly necessary in the case of non-parallel drives, e.g., quarter twist drives (Figure 61).

Again, the risk of accidental dismounting is reduced by the substitution of pulleys of the rounded rim type, on which the belt tends to climb to the crown of the pulley.

VI.—SAFETY RULES FOR WORKERS.

The safety appliances and other safety precautions described above will, where adopted, go far to prevent the occurrence of accidents due to the dangerous practice of mounting belts by direct handling at ordinary speed. They require, however, to be supplemented by enforcing observance of safety rules by the workers. Many workers accustomed to mounting belts by hand do not regard the operation as dangerous, and it is difficult to persuade them that it is, particularly as regards small belts working under moderate tension. All workers, whether trained or not, should therefore be expressly forbidden to approach unfenced transmission machinery for the purpose of mounting belts by hand, unless it is stopped or running dead-slow (see p. 4), and those in charge should see that the prohibition is strictly observed. Shafting ladders, such as are often provided in industrial premises to give access to bearings for overhead shafting, should not be so used when the machinery is at work.

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